

Part Number : FK-FA1415

Product Name : MULTI-FUNCTION 7-SEGMENT 4 DIGIT SHIELD

This is the experimental board for Multi-Function 7-Segment 4 Digit Shield as the fundamental controlling programming. It can be used to connect with sensors such as Temperature Controller, Moisture Indicator, Infrared Receiver Module, Ultrasonic Module. This circuit is adaptable and is able to upgrade to the other form of circuit such as Temperature Controller.

Specification

- 1.Power Supply direct from Microcontroller Board.
- 2.The circuit can be used with Microcontroller Board such as Arduino UNO R3.
- 3.The circuit board is composed of 3 sets which are Multi-Function 7-Segment 4 Digit Shield, 3 pieces of Switch and Sensor Connector such as Temperature Controller, Moisture Indicator, Infrared Receiver Module.
- 4.PCB dimension : 2.62"x2.24"

Circuit Function

The circuit is composed of 3 main sections:

Section1 Multi-Function 7-Segment 4 Digit Shield has 2 portions which are Segment portion and Common portion. The Segment portion will be connected with the port P2 – P9. P9 is Segment A, P6 is Segment B, P3 is Segment C, P4 is Segment D, P5 is Segment E, P8 is Segment F, P2 is Segment G and P7 is an optional port to display DOT or COLLON by choosing one of them from JP3 point. The Common portion will be connected with the port P10 – P13. P10 is Common 1, P12 is Common2, P13 is Common3 and P11 is Common4. The transistor will be used as a driver of Multi-Function 7-Segment 4 Digit Shield.

Section2 There are 3 switches in Switch circuit connected with the port A0,A1 and A2.

Section3 is for connecting with Sensor Connectors;

-CON1 is used to connect with Moisture Indicator DHT11, DHT22 or Ultrasonic Module HC-SR04 through the port A4 and A5. To connect CON1 with Moisture Indicator, jump the jumper JA4 and JA5 but if we want to connect with Ultrasonic Module, remove the jumpers of JA4 and JA5 and jump both jumpers on the CON1 side.

-CON2 is used to connect with Moisture Indicator such as 18B20 through the port P7 by jumping JP1 on the CON1 side.

-CON3 is used to connect with Infrared Receiver Module through the port P8 by jumping JP2 on the CON3 side.

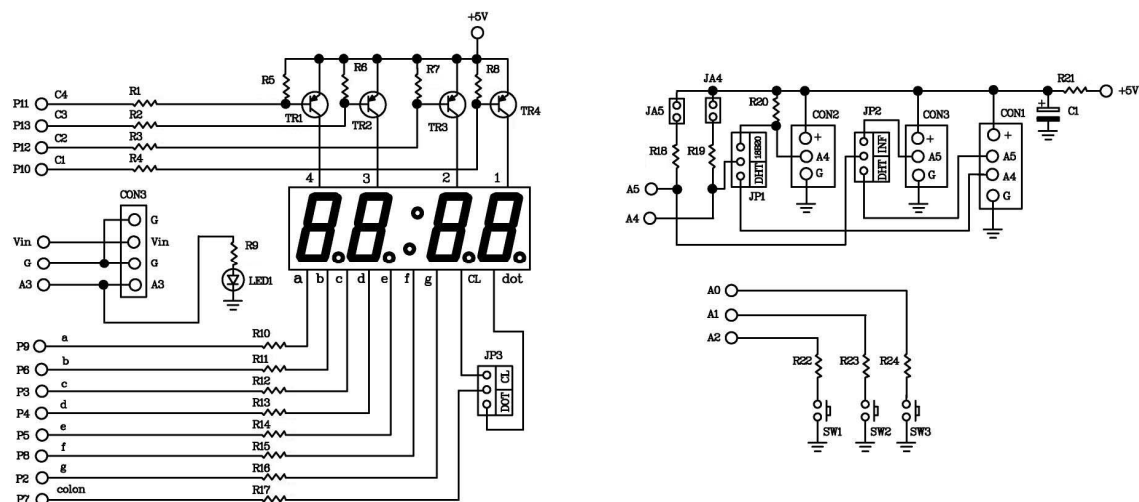


Figure 1. Circuit Diagram of FK1415

Circuit Assembling

According to Figure 2, the easy assembling should be started with putting the smallest part on the circuit which is resistor. Caution, all parts must be on the right electrodes such as LED. Please see Figure 3 for putting parts on electrodes. On the soldering, use a soldering iron max. 40 watts and tin/lead at 60/40 with flux. After assembling and soldering, re-check the positions of each part. In case some parts are on the wrong positions, use solder suction or solder wick to correct the positioning of those parts.

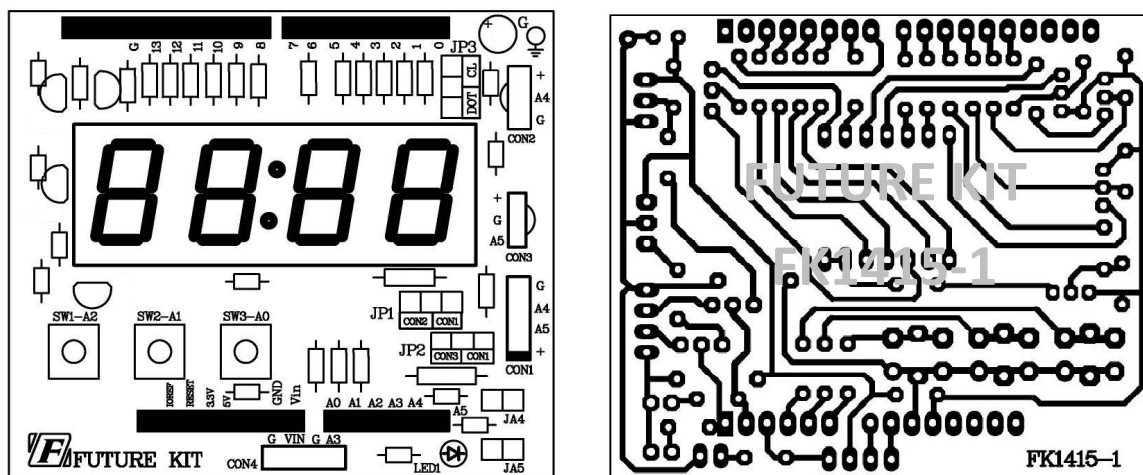


Figure 2. The positions for assembling and PCB copper line.

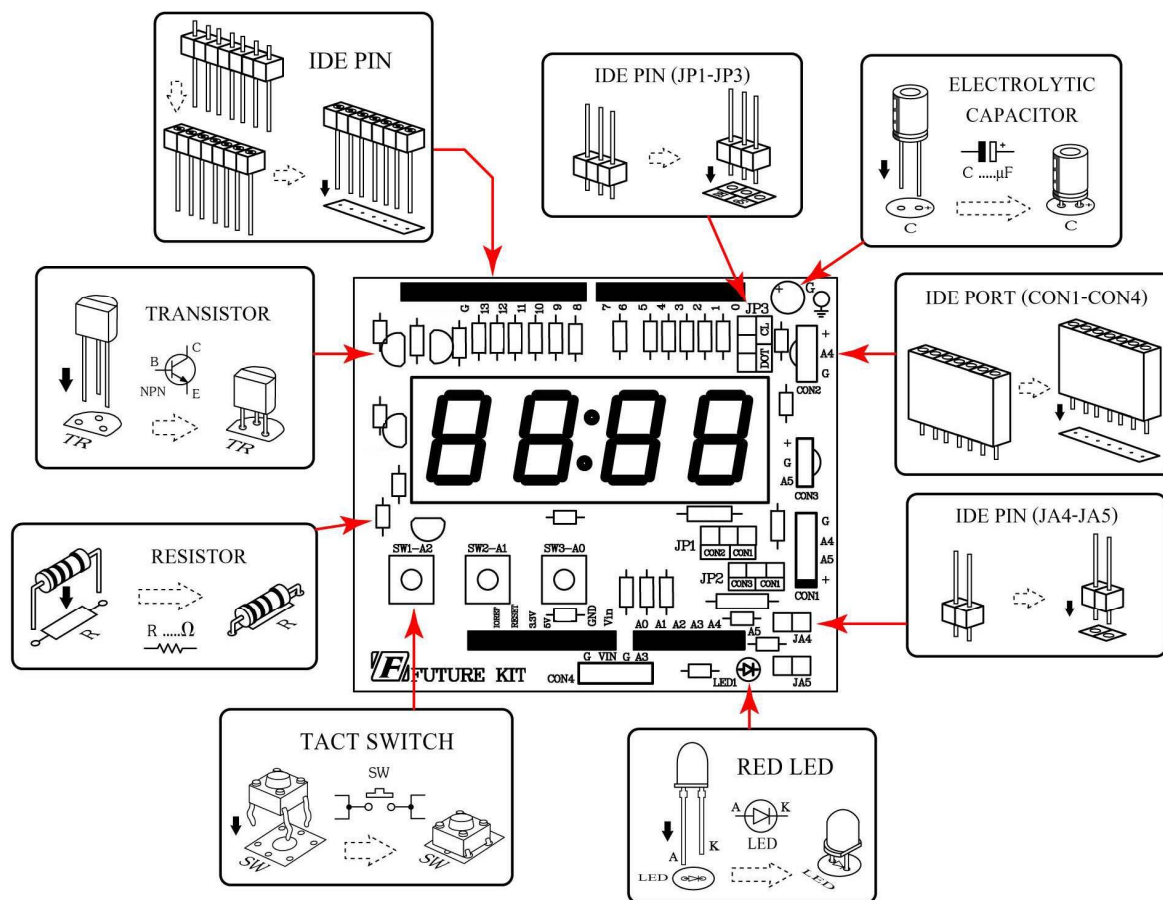


Figure 3. Positioning the parts on PCB

Programming instrument for the experimental board

1.FK-FA1415 MULTI-FUNCTION 7-SEGMENT 4 DIGIT SHIELD	1	set
2.Microcontroller Board ex. Arduino UNO R3	1	set
3.USB Cable	1	Piece
4.Computer Set	1	Set
5.Arduino Software	1	Piece

Testing Arduino UNO R3 Board

- 1.Connect USB cable with USB port of computer and USB port of Arduino UNO R3 Board.

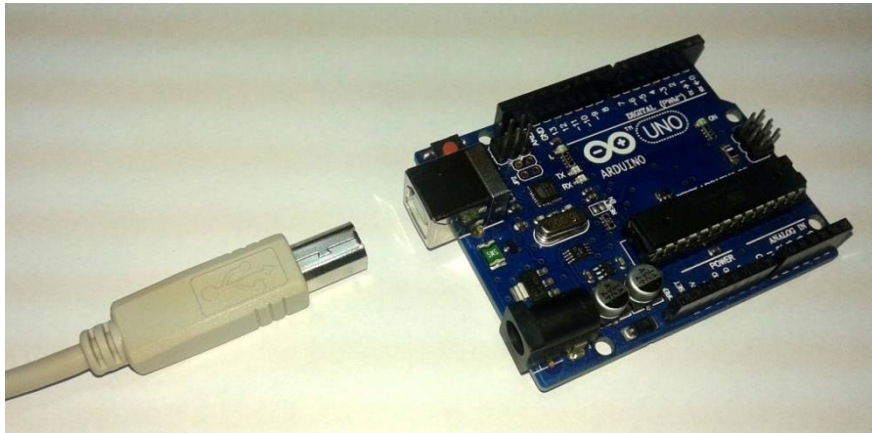


Figure 4. Connecting USB cable with USB port of Arduino Board

- 2.Open Arduino program by double-click on Arduino icon. Go to the menu bar, click on File and choose Open. Go to "EX" folder, open "TEST" folder and click on "Test" file.

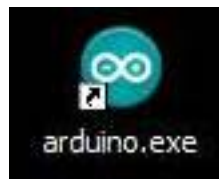


Figure 5. Opening Arduino program

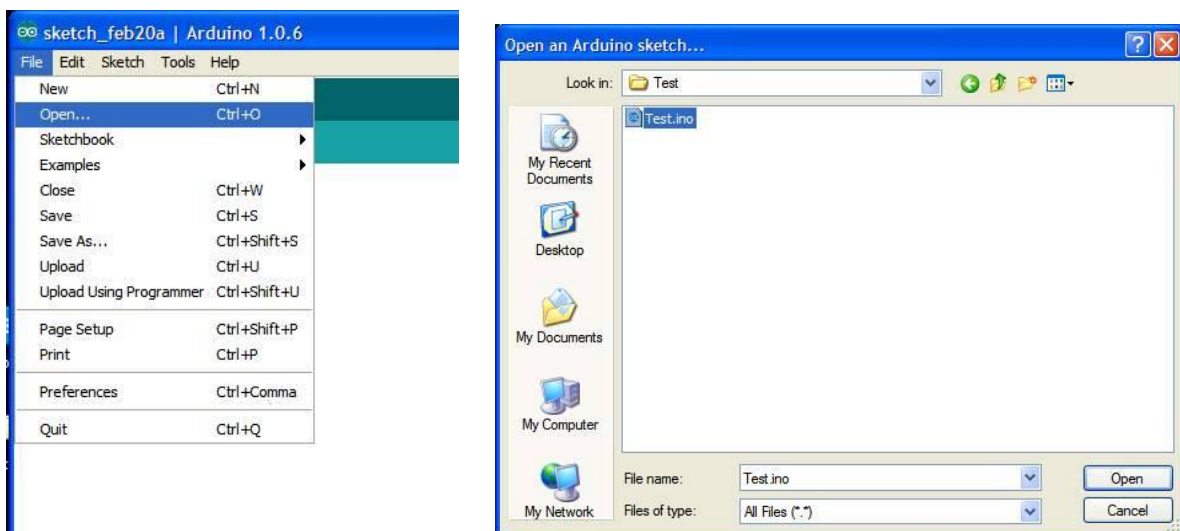


Figure 6. TEST Program

- 3.Download TEST program to Arduino Board.



Figure 7. Downloading TEST program

4. After downloading, the LED L on Arduino Board will blink which means Arduino board is working.



Figure 8. The position of LED L on Arduino Board circuit

The details of TEST program, Flashing Light Program, Arduino UNO R3 experiment.

```
void setup() {  
    pinMode(13, OUTPUT);    // Set the pin 13 is OUTPUT pin.  
}  
  
void loop() {  
    digitalWrite(13, HIGH);    // LED at the pin 13 is light-on.  
    delay(1000);              // delay time 1 second  
    digitalWrite(13, LOW);    // LED at the pin 13 is light-off.  
    delay(1000);              // delay time 1 second  
}
```

The method to connect the circuit with Arduino UNO R3 board

Connect FK1415 board with Arduino UNO R3 board by following Figure 9.

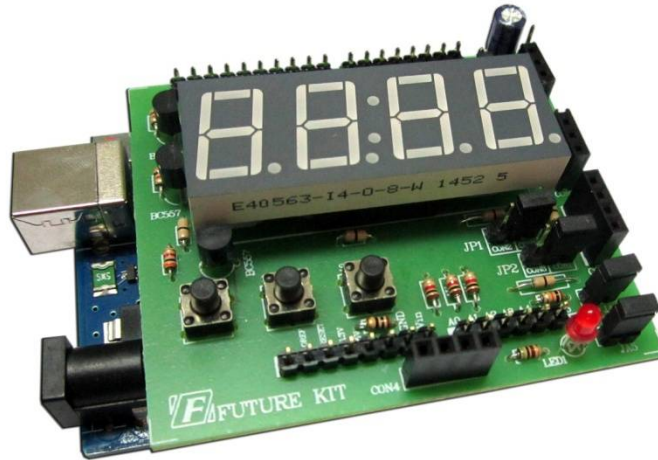


Figure 9. Connecting FK1415 board with Arduino UNO R3 board

Programming

- 1.Connect Arduino UNO R3 board with experimental board by following the instruction of the method to connect the circuit with Arduino UNO R3 board. Jump the jumper JP3 at CL point.
- 2.Connect the USB cable with USB port of computer and USB port of Arduino UNO R3 board.

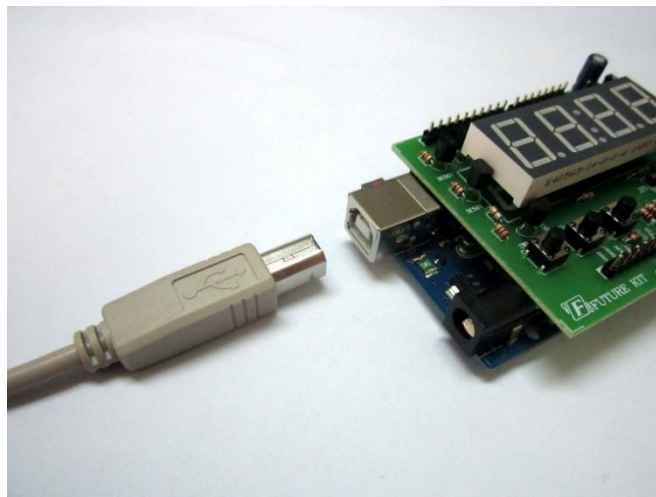


Figure 10. Wiring the USB cable

- 3.Double-click on Arduino icon to open Arduino program. Go to "File" in menu bar and choose "Open". Click on folder "Ex", choose folder "FK1415", choose folder "LAB1415-1" and click on file "LAB1415-1".

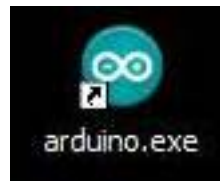


Figure 11. Opening Arduino Program

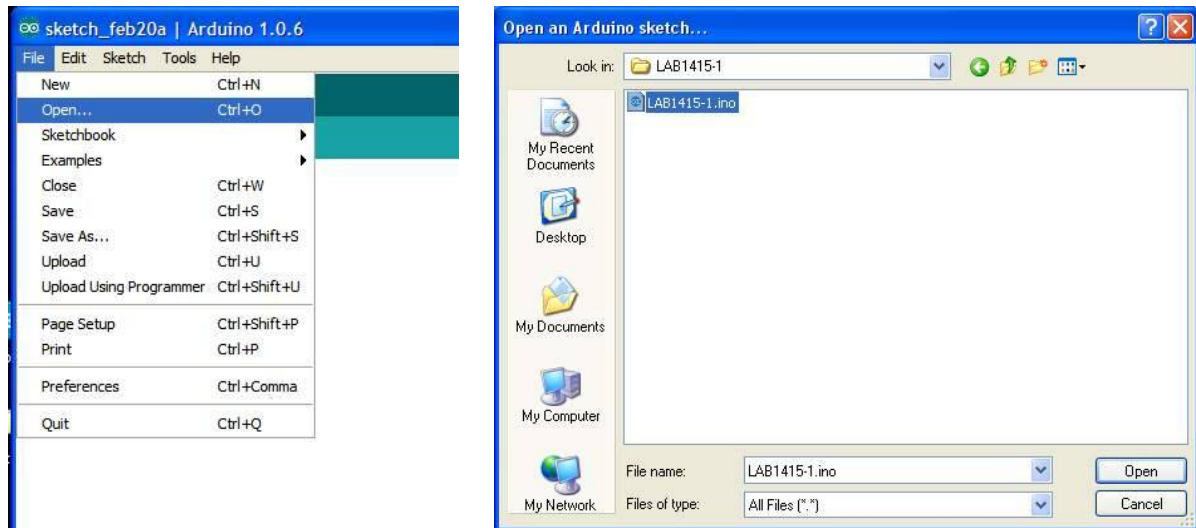


Figure 12. LAB1415-1 program

4.Download LAB1415-1 program to Arduino board.



Figure 13. Downloading LAB1415-1 program

5.After completing downloading, the 7-segment at FK1415 board will display the numeric "2" and "9" alternately which means the display circuit section is working.

6.Connect LED TEST with CON3 point. The pin of Resistor must be connected with G point and the pin of LED TEST must be connected with A5 and put the jumper JP2 in the CON3 side. Open

LAB1415-2 program in folder "FK1415". Download LAB1415-2 program to Arduino board, LED TEST will blink. Afterwards, remove LED TEST and connect it with CON2 point, do it in the same way as connecting with CON3 point but change the pin's position from A5 to A4 together with putting the jumper JP1 in the CON2 side. LED TEST will blink. Remove LED TEST and connect it with CON1 point and put the pin that's no connection with Resistor in A4, then A5 together with putting the jumper JP1 and JP2 in the CON1 side. If LED blinks, it means the connector point is working.

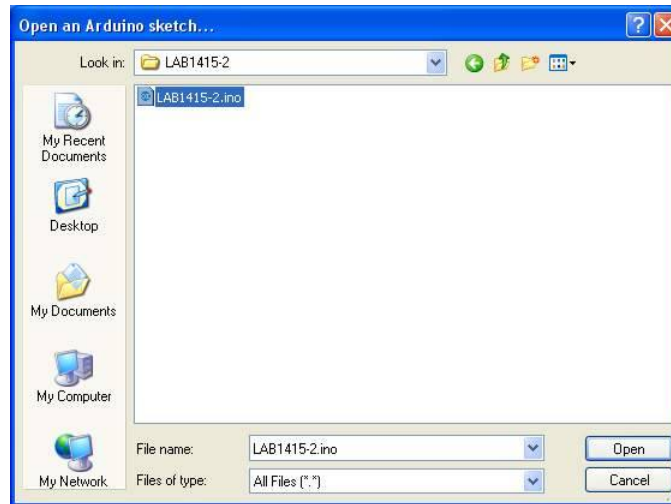


Figure 14. LAB1415-2 program



Figure 15. Downloading LAB1415-2 program

7. Open LAB1415-3 in folder "FK1415" and download this program to Arduino UNO R3 board.

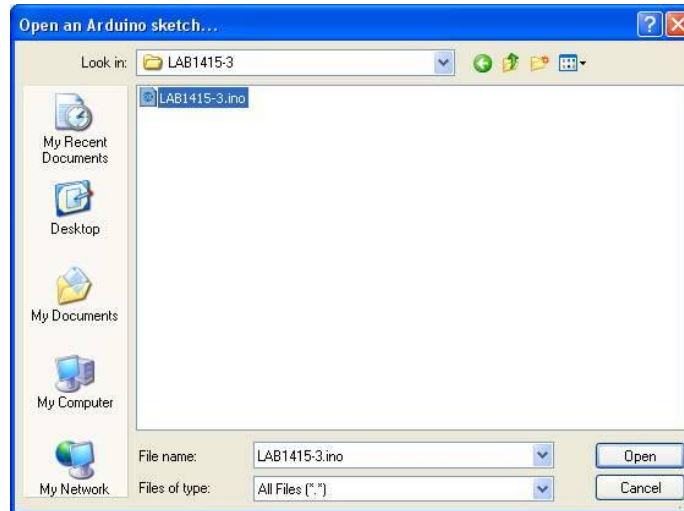


Figure 16. LAB1415-3 program

8.Press and hold switch SW1, LED1 will be light-on, release switch SW1, LED1 will be light-off.

9.Press and hold switch SW2, LED1 will be light-on, release switch SW2, LED1 will be light-off.

10.Press and hold switch SW3, LED1 will be light-on, release switch SW3, LED1 will be light-off.

11.If the test in step 8 to step 10 works, it means the switch circuit is functional.

The details of LAB1415-1 7-SEGMENT DISPLAY TEST program

```
int Com1 = 11;           // Set "COM1" word is the variable of value at pin 11.
int Com2 = 13;           // Set "COM2" word is the variable of value at pin 13.
int Com3 = 12;           // Set "COM3" word is the variable of value at pin 12.
int Com4 = 10;           // Set "COM4" word is the variable of value at pin 10.
int SegmentA = 9;        // Set "SegmentA" word is the variable of value at pin 9.
int SegmentB = 6;        // Set "SegmentB" word is the variable of value at pin 6.
int SegmentC = 3;        // Set "SegmentC" word is the variable of value at pin 3.
int SegmentD = 4;        // Set "SegmentD" word is the variable of value at pin 4.
int SegmentE = 5;        // Set "SegmentE" word is the variable of value at pin 5.
int SegmentF = 8;        // Set "SegmentF" word is the variable of value at pin 8.
int SegmentG = 2;        // Set "SegmentG" word is the variable of value at pin 2.
int CollonDot = 7;       // Set "CollonDot" word is the variable of value at pin 7.
```

```
void setup() {  
    pinMode(SegmentA, OUTPUT);    // Set "SegmentA" is OUTPUT pin.  
    pinMode(SegmentB, OUTPUT);    // Set "SegmentB" is OUTPUT pin.  
    pinMode(SegmentC, OUTPUT);    // Set "SegmentC" is OUTPUT pin.  
    pinMode(SegmentD, OUTPUT);    // Set "SegmentD" is OUTPUT pin.  
    pinMode(SegmentE, OUTPUT);    // Set "SegmentE" is OUTPUT pin.  
    pinMode(SegmentF, OUTPUT);    // Set "SegmentF" is OUTPUT pin.  
    pinMode(SegmentG, OUTPUT);    // Set "SegmentG" is OUTPUT pin.  
    pinMode(Com1, OUTPUT);        // Set "Com1" is OUTPUT pin.  
    pinMode(Com2, OUTPUT);        // Set "Com2" is OUTPUT pin.  
    pinMode(Com3, OUTPUT);        // Set "Com3" is OUTPUT pin.  
    pinMode(Com4, OUTPUT);        // Set "Com4" is OUTPUT pin.  
    pinMode(CollonDot, OUTPUT);   // Set "CollonDot" is OUTPUT pin.  
}  
  
void loop() {  
    #define COM_ON HIGH           // Set status of "COM_ON" is HIGH.  
    #define COM_OFF LOW          // Set status of "COM_OFF" is LOW.  
    #define SEGMENT_ON LOW       // Set status of "SEGMENT_ON" is LOW.  
    #define SEGMENT_OFF HIGH     // Set status of "SEGMENT_OFF" is HIGH.  
    digitalWrite(CollonDot, LOW); // Set the value of "CollonDot" pin is LOW.  
    digitalWrite(Com1, COM_OFF);  // Set the value of "Com1" pin is LOW.  
    digitalWrite(Com2, COM_OFF);  // Set the value of "Com2" pin is LOW.  
    digitalWrite(Com3, COM_OFF);  // Set the value of "Com3" pin is LOW.  
    digitalWrite(Com4, COM_OFF);  // Set the value of "Com4" pin is LOW.  
  
    digitalWrite(SegmentA, SEGMENT_ON);  
    digitalWrite(SegmentB, SEGMENT_ON);  
    digitalWrite(SegmentC, SEGMENT_OFF);  
    digitalWrite(SegmentD, SEGMENT_ON);
```

```
digitalWrite(SegmentE, SEGMENT_ON);
digitalWrite(SegmentF, SEGMENT_OFF);
digitalWrite(SegmentG, SEGMENT_ON);    // The display is showing the numeric "2".
delay(1000);                          // delay time 1 second

digitalWrite(SegmentA, SEGMENT_ON);
digitalWrite(SegmentB, SEGMENT_ON);
digitalWrite(SegmentC, SEGMENT_ON);
digitalWrite(SegmentD, SEGMENT_ON);
digitalWrite(SegmentE, SEGMENT_OFF);
digitalWrite(SegmentF, SEGMENT_ON);
digitalWrite(SegmentG, SEGMENT_ON);    // The display is showing the numeric "9".
delay(1000);                          // delay time 1 second
}
```

Function of LAB1415-1 program

The function of LAB1415-1 program starts from setting the integer of each pin such as setting the integer of COM1 as P11, setting the integer of Segment B as P6. Afterwards, set every pin as OUTPUT pin. Set the screen of 7 Segment to display the digit 2 and 9 alternately at 1 second. The screen will display these two digits continually.

Remark: In case we want to speed up the alternation of digit 2 and 9, we can reduce the value in the parentheses by commanding "delay". The unit of the digit is millisecond.

The details of LAB1415-2 CON1-CON3 CONNECTOR TEST program

```
void setup() {
    pinMode(A4, OUTPUT);    // Set the pin A4 is OUTPUT pin.
    pinMode(A5, OUTPUT);    // Set the pin A5 is OUTPUT pin.
}

void loop() {
    digitalWrite(A4, HIGH);  // LED at the pin A4 is light-on.
    digitalWrite(A5, HIGH);  // LED at the pin A5 is light-on.
    delay(1000);            // delay time 1 second
}
```

```
digitalWrite(A4, LOW);           // LED at the pin A4 is light-off.

digitalWrite(A5, LOW);           // LED at the pin A5 is light-off.

delay(1000);                     // delay time 1 second

}
```

Function of LAB1415-2 program

The program will determine pin A4 and pin A5 as OUTPUT pin. It will light up the LED at pin A4 to pin A5 at 1 second and will extinguish at 1 second, the program will start repeating the all LED.

Remark: In case we want LED ON/OFF frequency, we can reduce the value in the parentheses by commanding “delay”. The unit of the digit is millisecond.

The details of LAB1415-3 SWITCH TEST program

```
void setup() {

    pinMode(A3, OUTPUT);           // Set the pin A3 is OUTPUT pin.

    pinMode(A2, INPUT_PULLUP);     // Set the pin A2 is INPUT pin and using the PULL UP
function.

    pinMode(A1, INPUT_PULLUP);     // Set the pin A1 is INPUT pin and using the PULL UP
function.

    pinMode(A0, INPUT_PULLUP);     // Set the pin A0 is INPUT pin and using the PULL UP
function.

}

void loop() {

    int SW3 = digitalRead(A0);      // Set “SW3” word is the variable of value at pin A0.

    int SW2 = digitalRead(A1);      // Set “SW2” word is the variable of value at pin A1.

    int SW1 = digitalRead(A2);      // Set “SW1” word is the variable of value at pin A2.

    if (SW3 == LOW) { digitalWrite(A3, HIGH); } else { digitalWrite(A3, LOW); }

    // If press the switch SW3 (LOW status), LED at pin A3 will be light-on. But if no press the
switch SW3 (HIGH status), LED at pin A3 will be light-off.

    if (SW2 == LOW) { digitalWrite(A3, HIGH); } else { digitalWrite(A3, LOW); }

    // If press the switch SW2 (LOW status), LED at pin A3 will be light-on. But if no press the
switch SW2 (HIGH status), LED at pin A3 will be light-off.

    if (SW1 == LOW) { digitalWrite(A3, HIGH); } else { digitalWrite(A3, LOW); }

    // If press the switch SW1 (LOW status), LED at pin A3 will be light-on. But if no press the
switch SW1 (HIGH status), LED at pin A3 will be light-off.

}
```

}

Fuction of LAB1415-3 program

The program will determine pin A3 as OUTPUT pin and pin A0 to pin A2 as INPUT pin.
Besides INPUT pin, pin A0 to pin A2 can be used for activating the function PULL UP as well.

Press and hold switch SW3 at pin A0, LED will be light-on, release switch SW3, LED will be light-off.

Press and hold switch SW2 at pin A1, LED will be light-on, release switch SW2, LED will be light-off.

Press and hold switch SW1 at pin A2, LED will be light-on, release switch SW1, LED will be light-off.