

# **MIKROKONTROLER**

**PROGRAM STUDI**  
**TEKNIK TELKOMUNIKASI**  
Semester 3

Akuwan Saleh, MT

# REFERENSI

- Julien Bayle, “C Programming for Arduino”, Packt Publishing Ltd, Birmingham, May 2013.
- James Floyd K & Harold T , “Arduino Adventure Escape from Gemini Station”, Apress, 2013.
- Famosa Studio Arduino Starter Kit Manual – V1.0, Famosa Studio, 2013.
- Martin E, Joshua N, & Jordan H, “Arduino in Action“,Manning Publications.Co, USA, 2013.
- Jack Purdum, “Beginning C for Arduino, Learn C Programming for the Arduino and Compatible Microcontrollers”, Apress, 2012.
- John-David Warren, Josh Adams, and Harald Molle, “Arduino Robotics”, Springe, New York, 2011.
- \_\_\_\_\_, Sistem minimum Arduino Uno/ATmega328, Instruction Manual, 2010.

# MATERI

1. PENDAHULUAN
2. ANTARMUKA MIKROKONTROLER DENGAN LIGHT EMITTING DIODE (LED)
3. ANTARMUKA MIKROKONTROLER DENGAN SAKLAR
4. **ANTARMUKA MIKROKONTROLER DENGAN LED DOT MARIK**
5. ANTARMUKA MIKROKONTROLER DENGAN KEYPAD
6. ANTARMUKA MIKROKONTROLER DENGAN SEVEN SEGMENT (7-S)
7. ANTARMUKA MIKROKONTROLER DENGAN LCD 2x16
8. PEMROGRAMAN MELODY
9. ANALOG INPUT (ADC)
10. KOMUNIKASI SERIAL
11. ANTARMUKA MIKROKONTROLER DENGAN LM 35
12. ANTARMUKA MIKROKONTROLER DENGAN LDR
13. ANTARMUKA MIKROKONTROLER DENGAN LAMPU AC 220V
14. ANTARMUKA MIKROKONTROLER DENGAN MOTOR DC
15. ANTARMUKA MIKROKONTROLER DENGAN SENSOR ULTRASONIC
16. Demo Tugas Proyek Semester

# **4. ANTARMUKA MIKROKONTROLER DENGAN LED DOT MATRIK**

- 1. TUJUAN**
- 2. Umum**
- 3. Dot Matrik LED Display**
- 4. Driver/Pengendali**
- 5. Rangkaian interface**
- 6. Program**

# TUJUAN

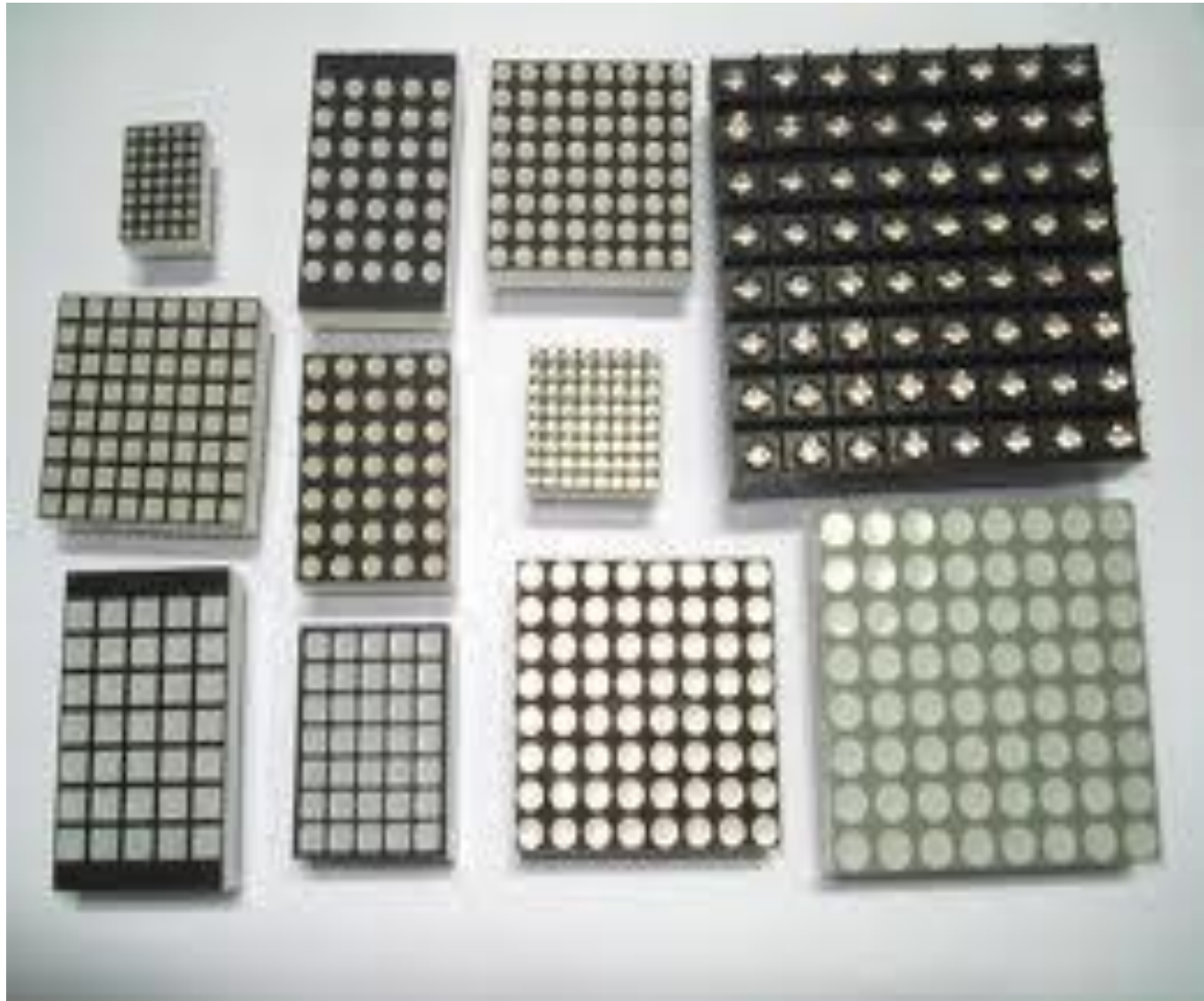
- Membuat aplikasi system tampilan karakter yang berupa LED Dot Matrik dengan menggunakan mikrokontroler Arduino
- Membuat program untuk menampilkan karakter pada media LED Dot Matrik

# DASAR TEORI

## Umum :

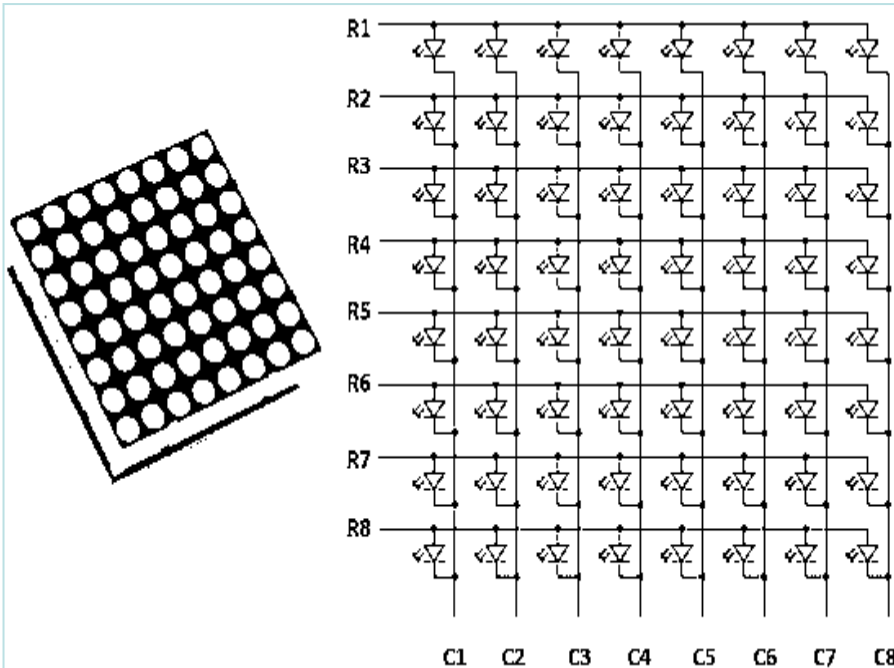
- **Display dot matrik** : Beberapa LED yang disusun membentuk matrik baris dan kolom yang bervariasi sesuai dengan tipenya.
- **Tipe**: 5x7 atau 8x8, berupa modul jadi atau dibuat sendiri dengan menyusun beberapa LED.
- **Ukuran**: ada yang besar, sedang maupun yang kecil.

# Secara fisik



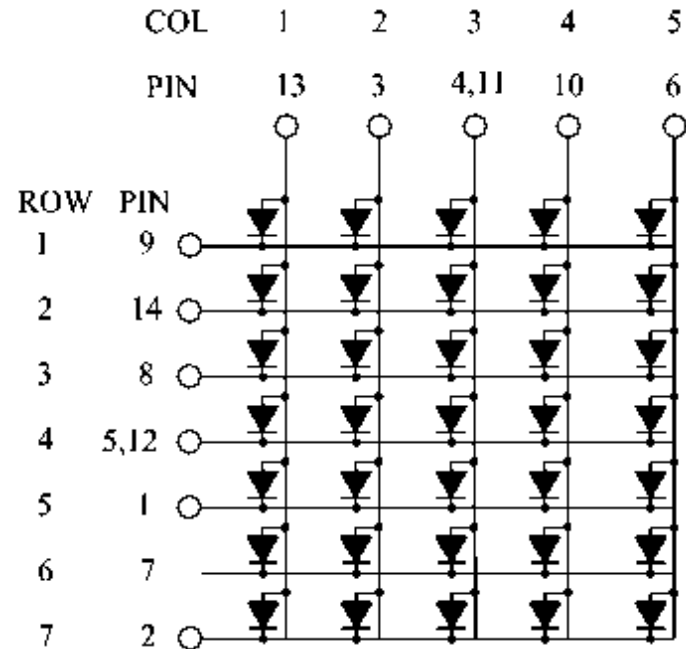
# Konfigurasi:

## ✓ Common Anode Row



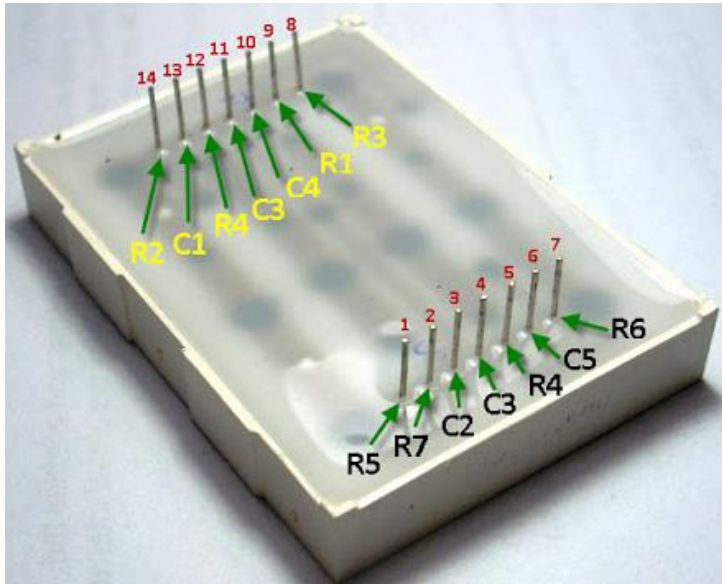
Baris = Anoda → +3,3V / +5V  
Kolom = Katoda → GND

## ✓ Common Cathode Row



Kolom = Anoda → +3,3V / +5V  
Baris = Katoda → GND



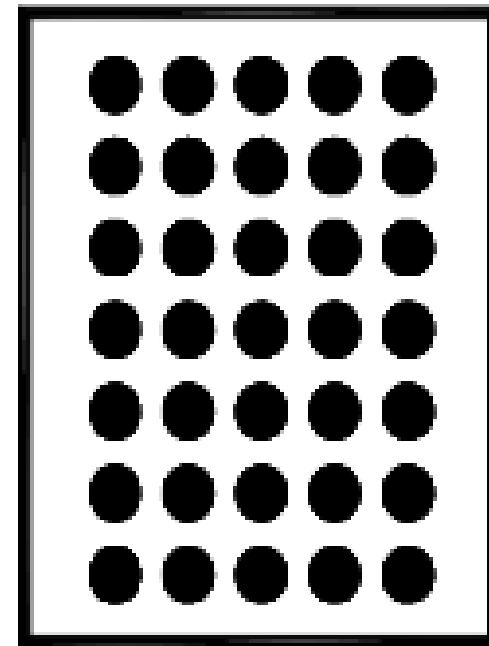
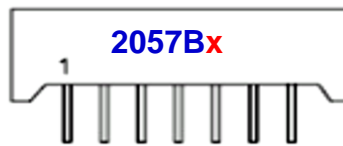
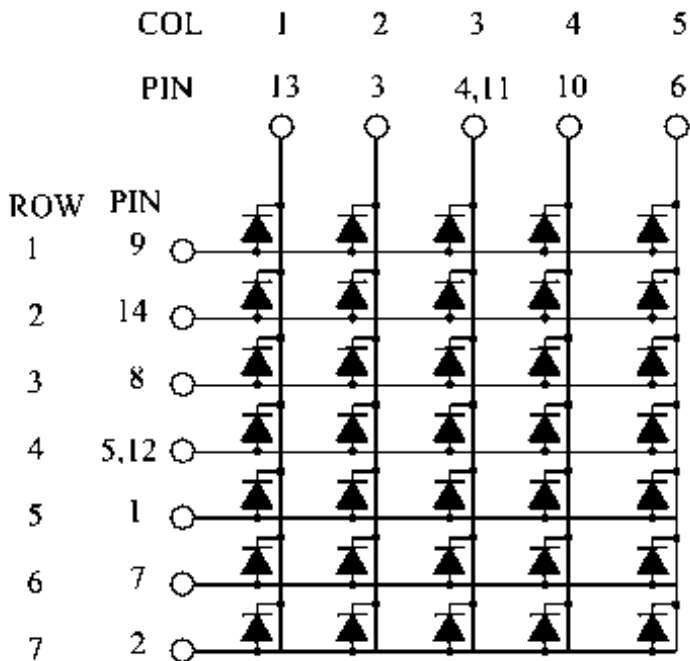


## Type HS-2057Bx (Common Anode)

Baris = Anoda

Kolom = Katoda

R2 C1 R4 C3 C4 R1 R3  
14 13 12 11 10 9 8



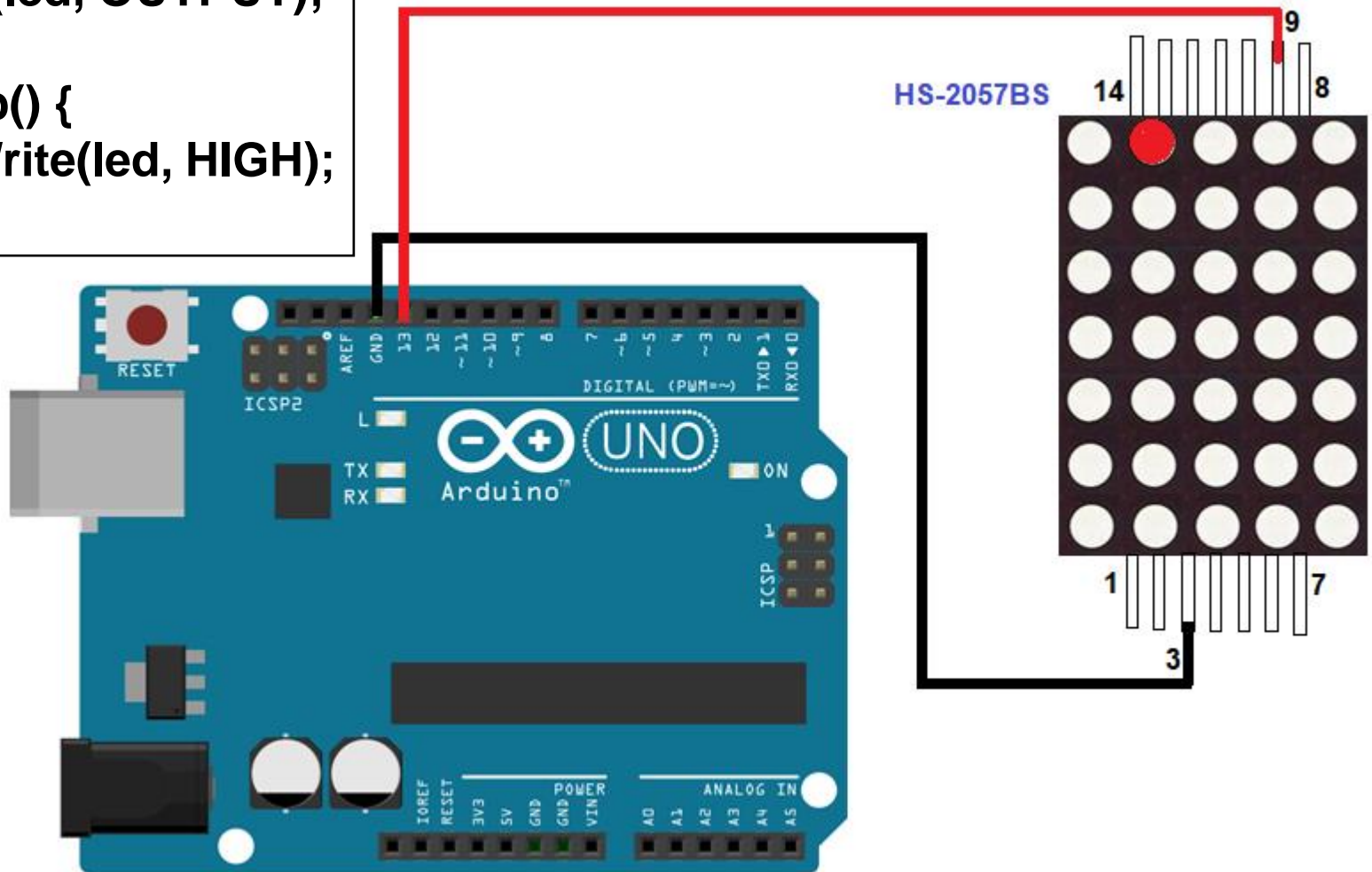
ROW1  
ROW2  
ROW3  
ROW4  
ROW5  
ROW6  
ROW7

1 2 3 4 5 6 7  
R5 R7 C2 C3 R4 C5 R6

# Cara Pengujian:

## Common Anode Row

```
int led = 13;  
  
void setup() {  
  pinMode(led, OUTPUT);  
}  
  
void loop() {  
  digitalWrite(led, HIGH);  
}
```

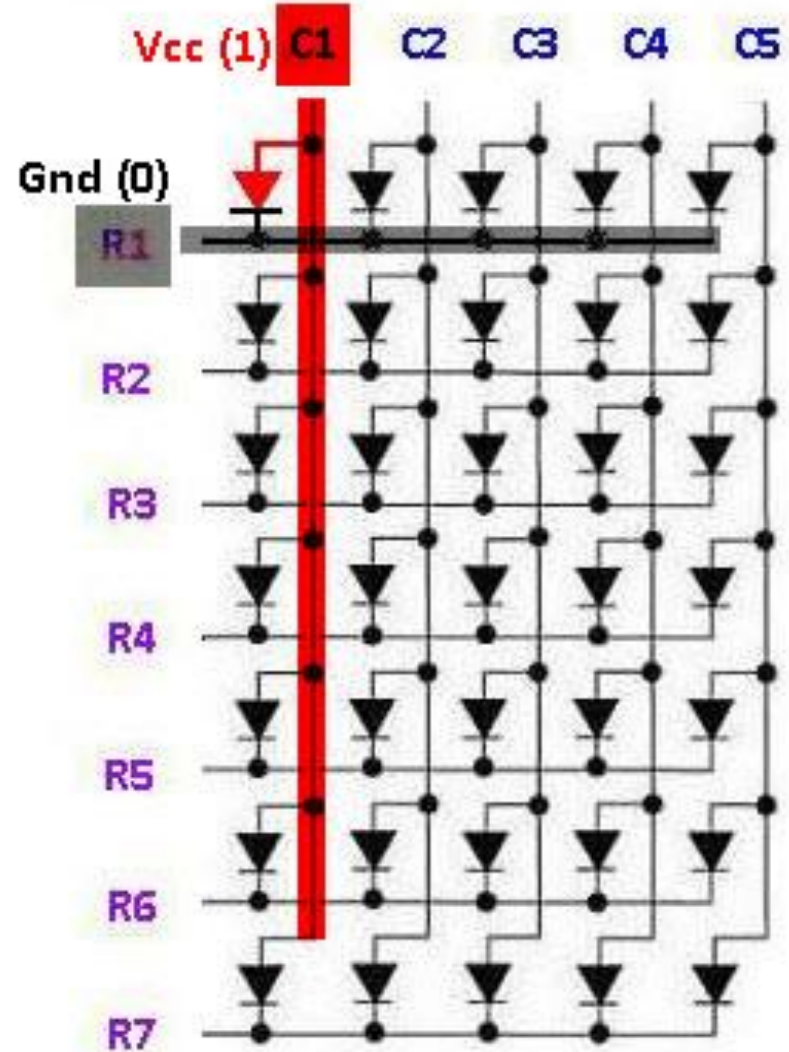
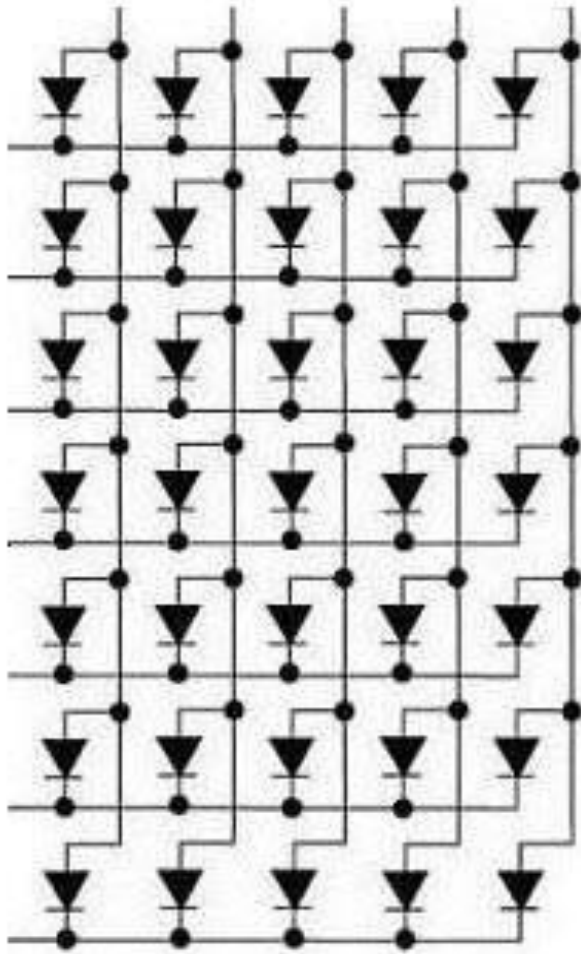


# Cara Pengujian:

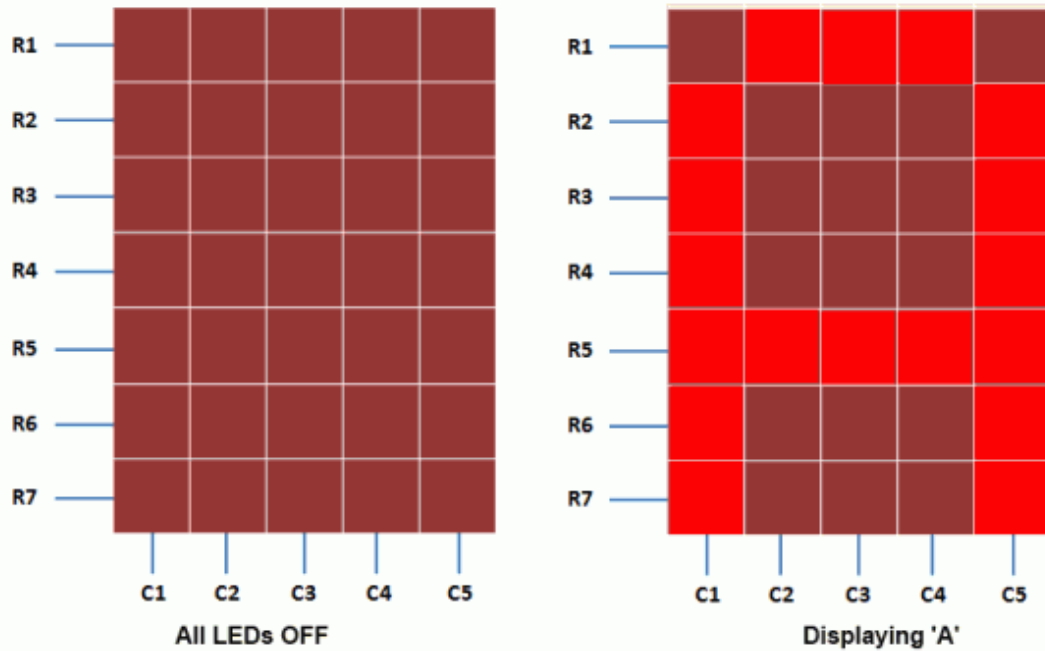
Common Cathode Row

Column → C1 C2 C3 C4 C5

R  
o  
w  
↓  
R1  
R2  
R3  
R4  
R5  
R6  
R7



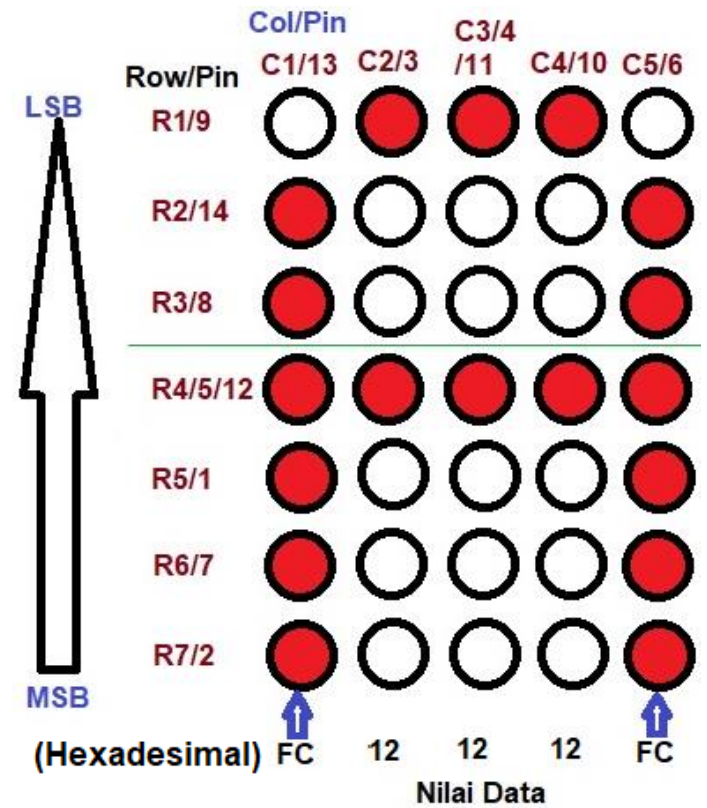
## 5x7 matrix of LEDs



| Row\Col | C1 | C2 | C3 | C4 | C5 |
|---------|----|----|----|----|----|
| R1      | 0  | 1  | 1  | 1  | 0  |
| R2      | 1  | 0  | 0  | 0  | 1  |
| R3      | 1  | 0  | 0  | 0  | 1  |
| R4      | 1  | 0  | 0  | 0  | 1  |
| R5      | 1  | 1  | 1  | 1  | 1  |
| R6      | 1  | 0  | 0  | 0  | 1  |
| R7      | 1  | 0  | 0  | 0  | 1  |

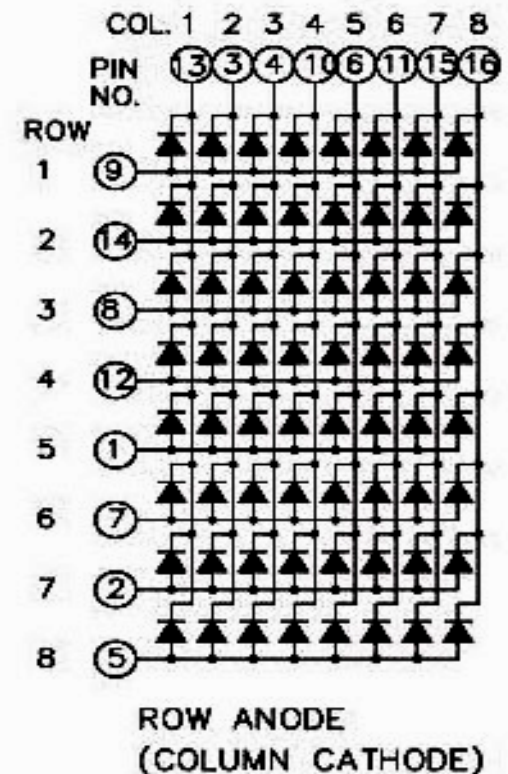
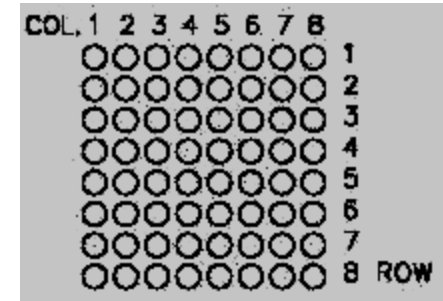
## BACA DATA

### LED DOT MATRIX COMMON ANODE ROW

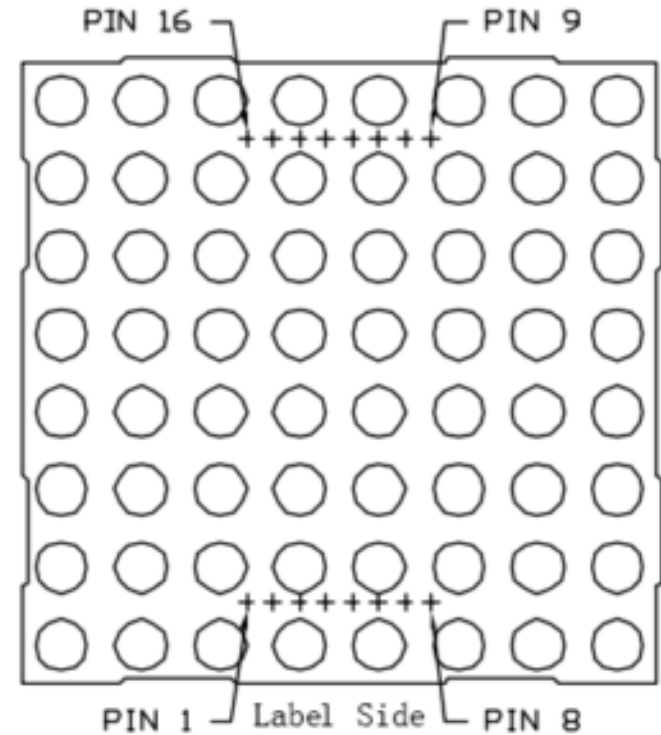
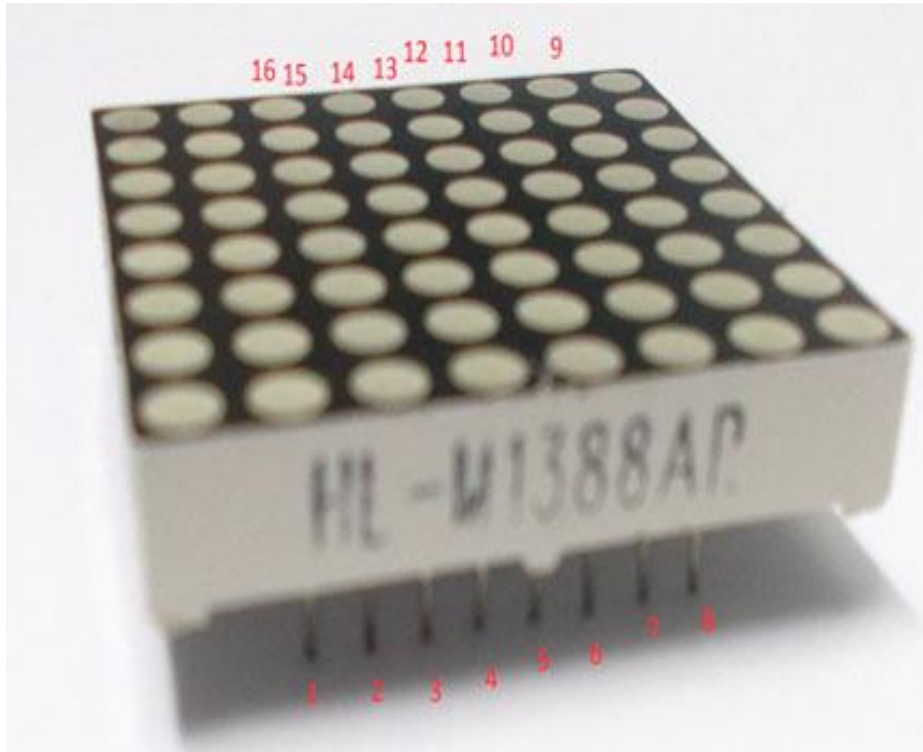


# Dot matrix led display 8x8

- Menampilkan (*display*) dari sebuah program yang dikirim secara paralel.
- Misalnya,  $8 \times 8$  matriks LED  
Anoda bersama-sama dalam baris (R1 - R8), dan katoda dalam kolom (C1 - C8), jumlah yang diperlukan **pin I/O = 16**.



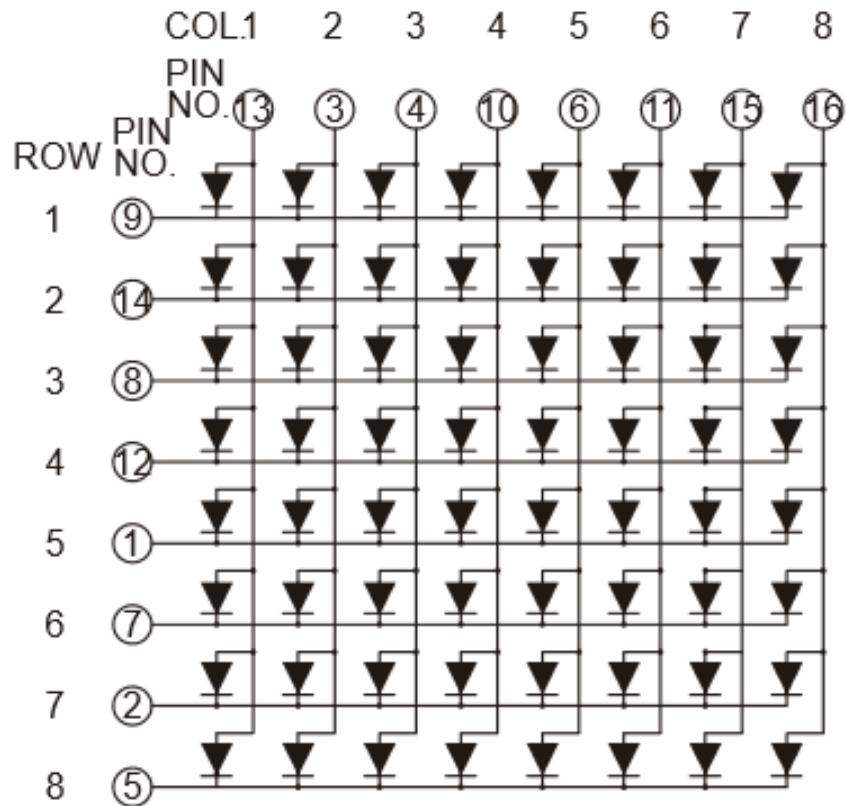




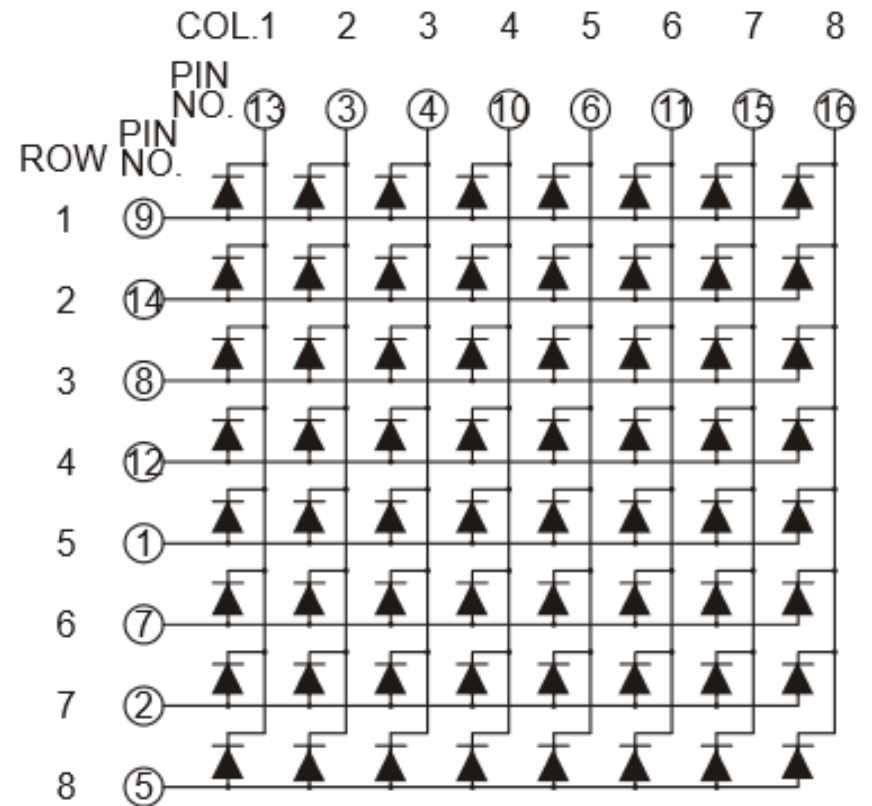
**Katoda** biasa ditandai dengan akhiran Ax, misalnya 2728AS.  
**Anoda** ditandai dengan akhiran Bx misalnya 3930BS

# Tipe Katoda 2088Ax dan Anoda 2088Bx

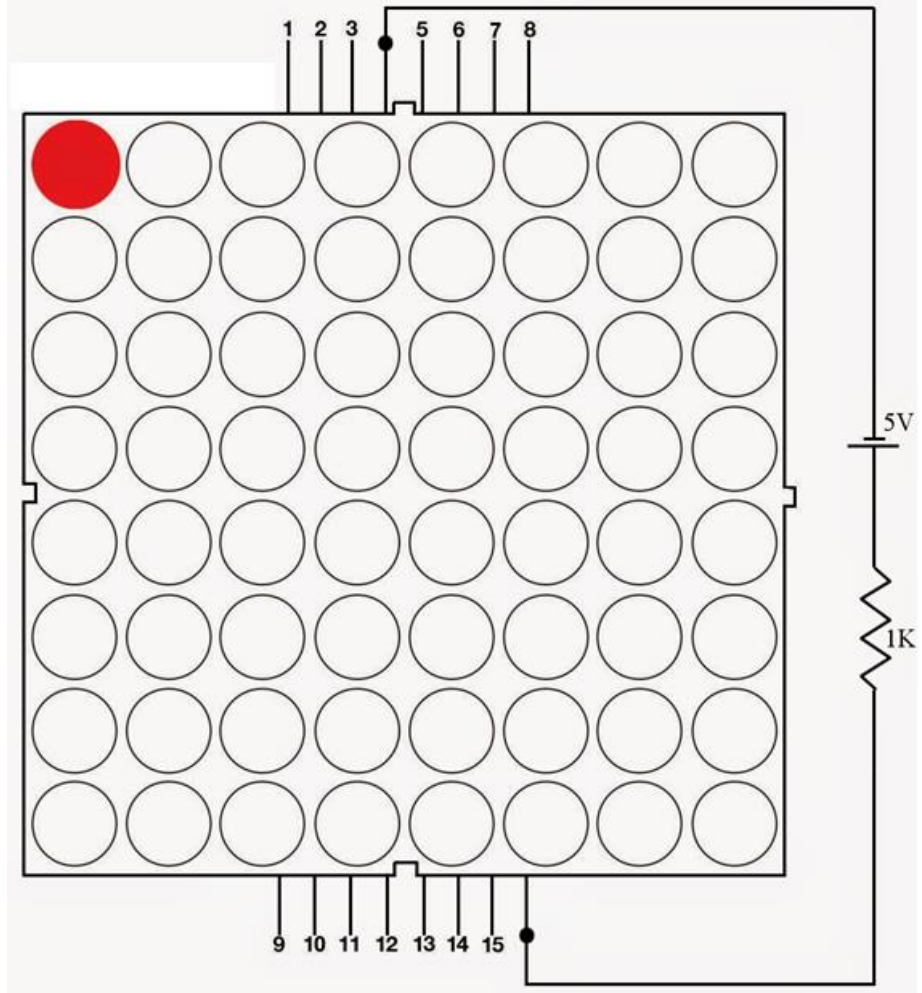
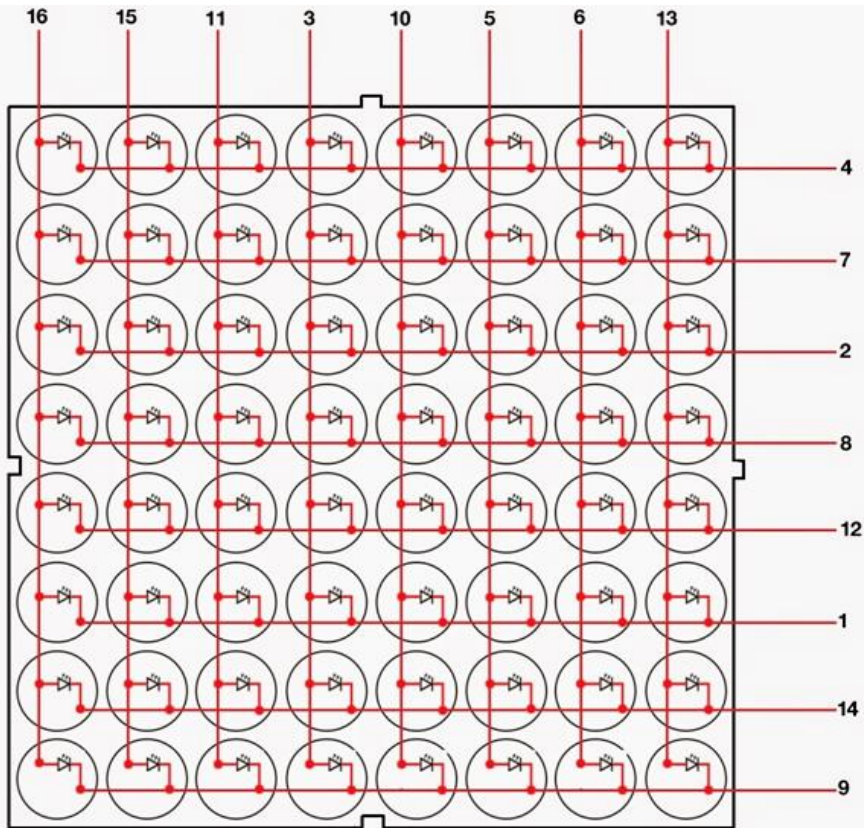
LM12088A (Common Cathode Row)



LM12088B (Common Anode Row)



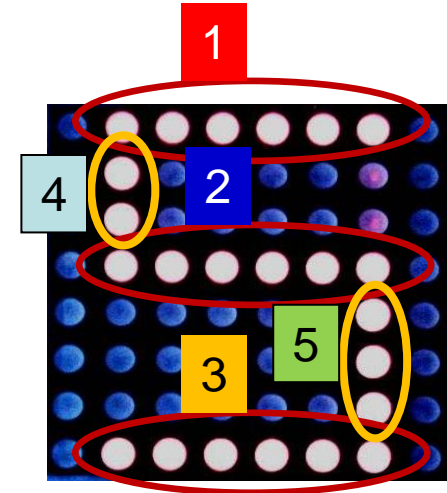
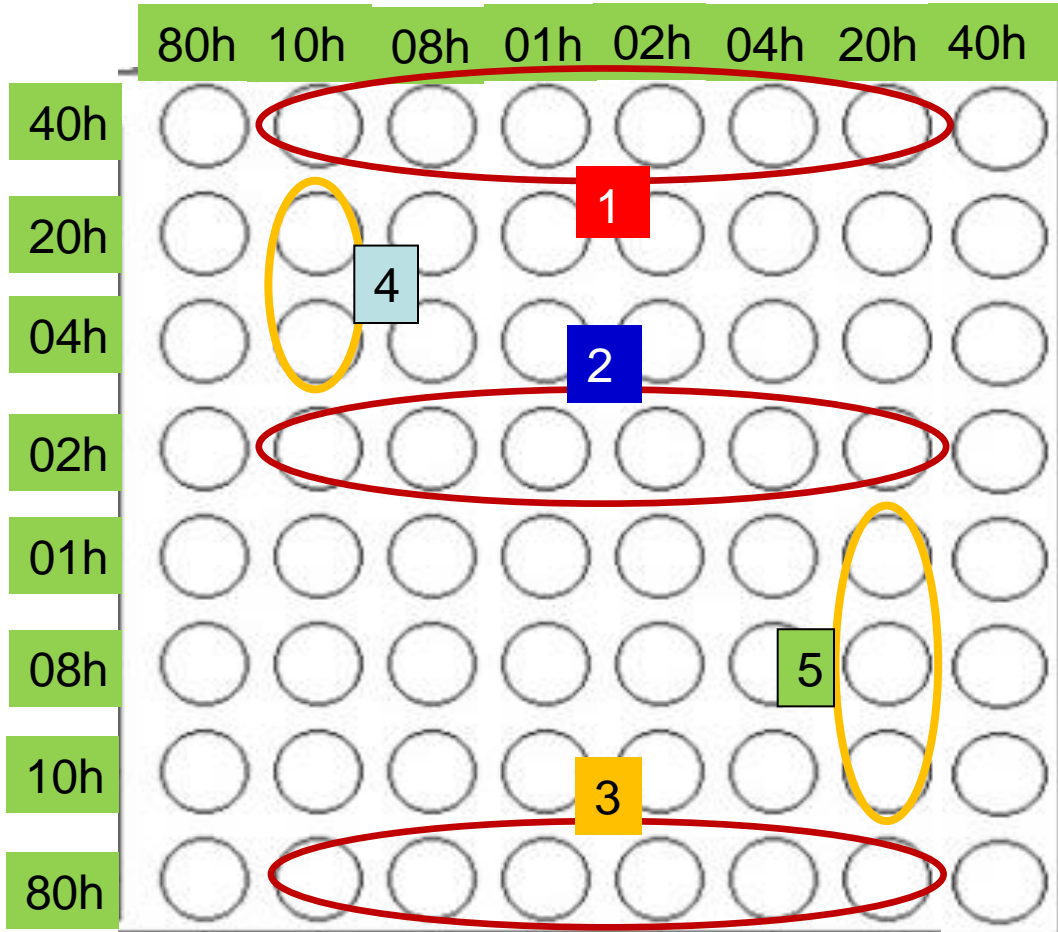
# Cara Pengujian:





# □ Scanning

- LED dot matrix 8x8 (Data Sheet)



1  
Col = 10+08+01+02+04+20=3Fh  
Row = 40h

2  
Col = 10+08+01+02+04+20=3Fh  
Row = 02h

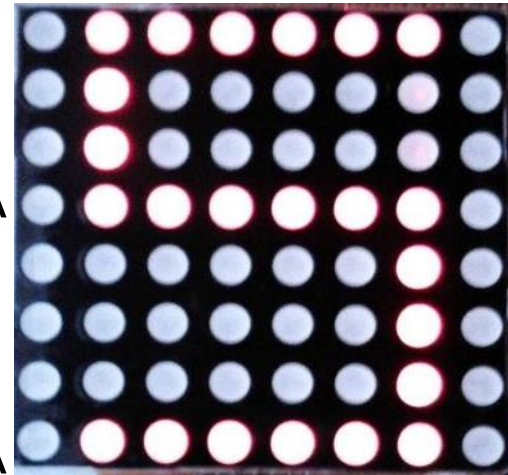
3  
Col = 10+08+01+02+04+20=3Fh  
Row = 80h

5  
Col = 20h  
Row = 01+08+10=19h

4  
Col = 10h  
Row = 20+04=24h

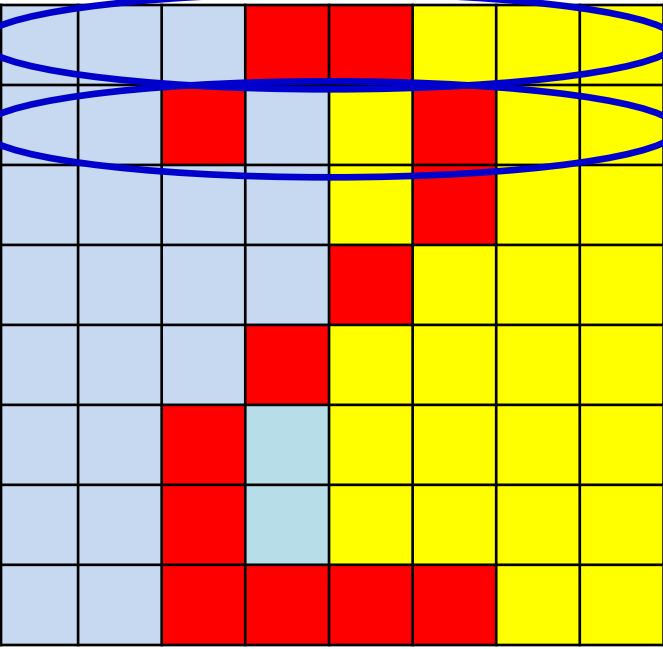
# Contoh Program: MCS-51

```
CEK4: CJNE A,#10H,CEK5
LIMA: MOV DPTR,#2000H
      MOV A,#3FH
      MOVX @DPTR,A
      MOV DPTR,#2001H
      MOV A,#40H
      MOVX @DPTR,A
      CALL DELAY
MOV DPTR,#2000H
  MOV A,#3FH
  MOVX @DPTR,A
  MOV DPTR,#2001H
  MOV A,#02H
  MOVX @DPTR,A
  CALL DELAY
MOV DPTR,#2000H
  MOV A,#3FH
  MOVX @DPTR,A
  MOV DPTR,#2001H
      MOV A,#80H
      MOVX @DPTR,A
      CALL DELAY
      MOV DPTR,#2000H
      MOV A,#10H
      MOVX @DPTR,A
      MOV DPTR,#2001H
      MOV A,#24H
      MOVX @DPTR,A
      CALL DELAY
      MOV DPTR,#2000H
      MOV A,#20H
      MOVX @DPTR,A
      MOV DPTR,#2001H
      MOV A,#19H
      MOVX @DPTR,A
      CALL DELAY
      LJMP START
```



# □ Scanning

- LED dot matrix 8x8

|  |  |
|--|--|
|  | Baris pertama menampilkan data pertama 18h     |
|  | Baris kedua menampilkan data kedua 24h         |
|  | Baris ketiga menampilkan data ketiga 04h       |
|  | Baris keempat menampilkan data keempat 08h     |
|  | Baris kelima menampilkan data kelima 20h       |
|  | Baris keenam menampilkan data keenam 20h       |
|  | Baris ketujuh menampilkan data ketujuh 20h     |
|  | Baris kedelapan menampilkan data kedelapan 3Ch |

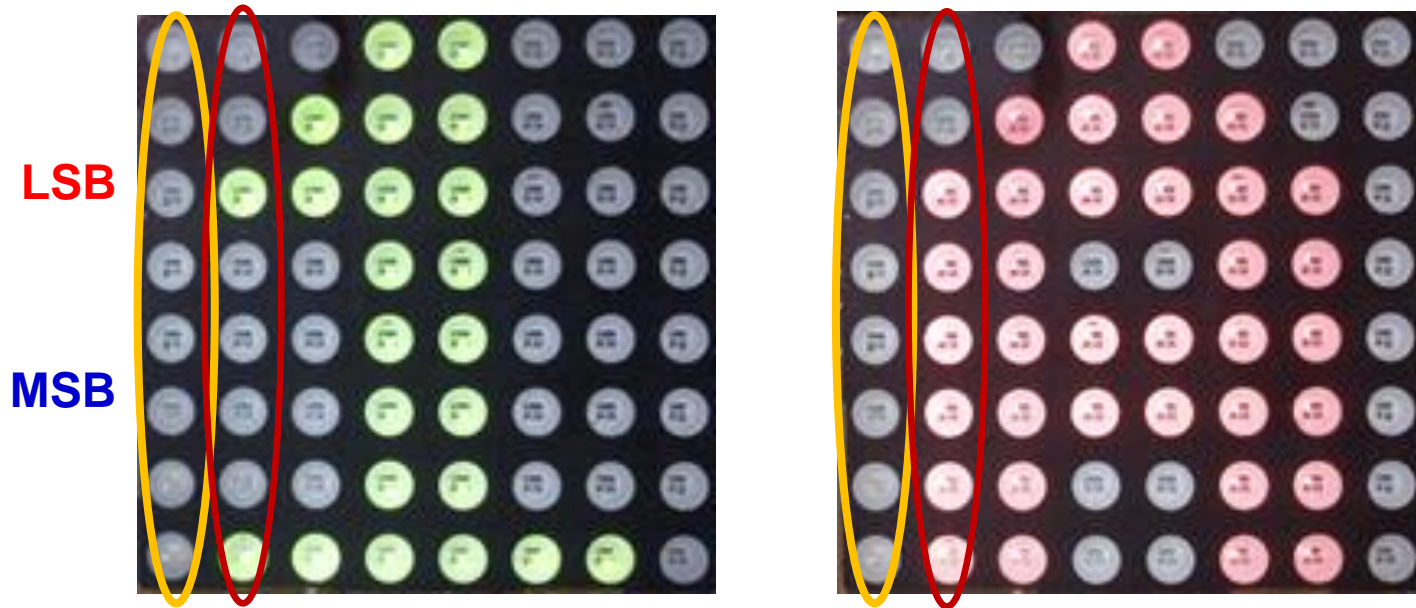
**MSB**                      **LSB**

**Nilai data karakter dalam variabel array :**

```
{0x18,0x24,0x24,0x24,0x24,0x24,0x24,0x18}, // 0  
{0x08,0x18,0x08,0x08,0x08,0x08,0x08,0x1C}, // 1  
{0x18,0x24,0x04,0x08,0x10,0x20,0x20,0x3C}, // 2  
{0x18,0x24,0x04,0x18,0x04,0x04,0x24,0x18}, // 3  
dst}
```

# □ Scanning

- LED dot matrix 8x8 dua warna

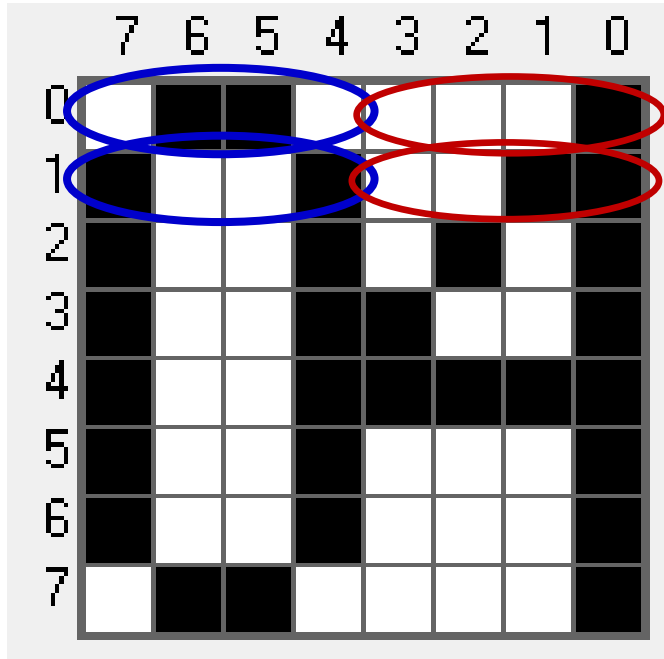


**Nilai data karakter dalam variabel array :**

```
{  
  0x00, 0x84, 0x86, 0xFF, 0xFF, 0x80, 0x80, 0x00, // 1  
  0x00, 0xFC, 0xFE, 0x37, 0x37, 0xFE, 0xFC, 0x0, // A  
}
```

## □ Scanning

- LED dot matrix 8x8 (dua data)



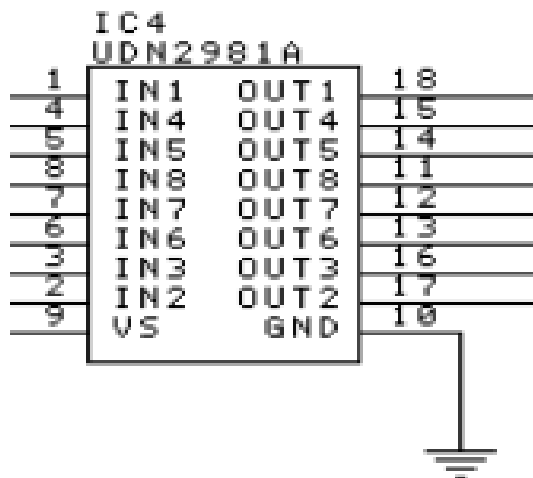
**Nilai data karakter dalam variabel array :**

```
{  
    0x06, 0x09, 0x09, 0x09, 0x09, 0x09, 0x09, 0x06, // 0  
    0x01, 0x03, 0x05, 0x09, 0x0f, 0x01, 0x01, 0x01, // 4  
}
```

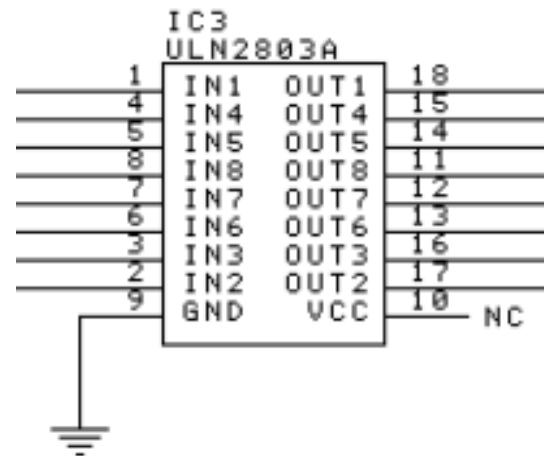
# Driver

- IC driver : UDN2981A dan ULN2803A
- UDN2981A : driver ke transistor sekaligus mengatur anoda LED.
- ULN2803A : driver ke transistor sekaligus mengatur katoda LED.

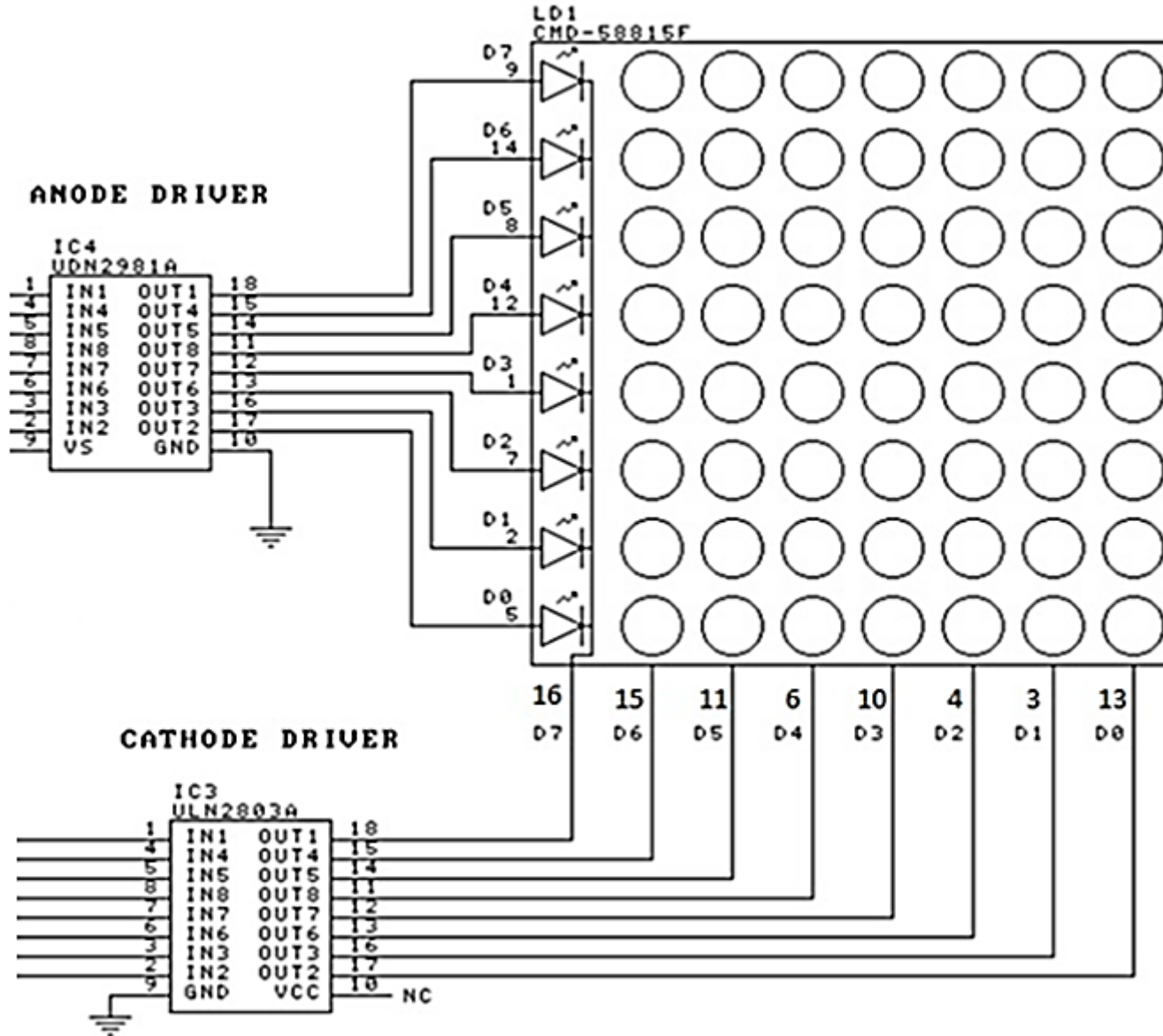
**ANODE DRIVER**



**CATHODE DRIVER**

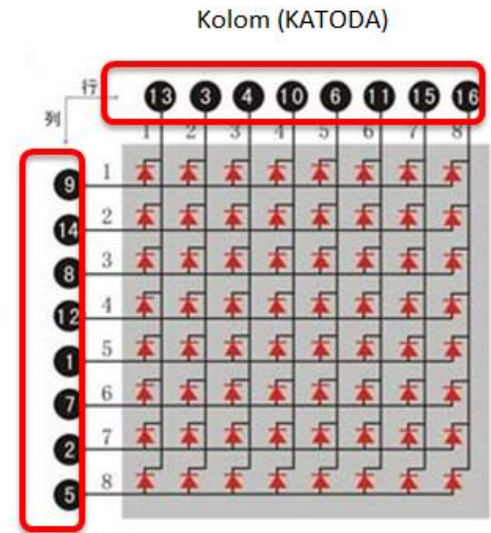
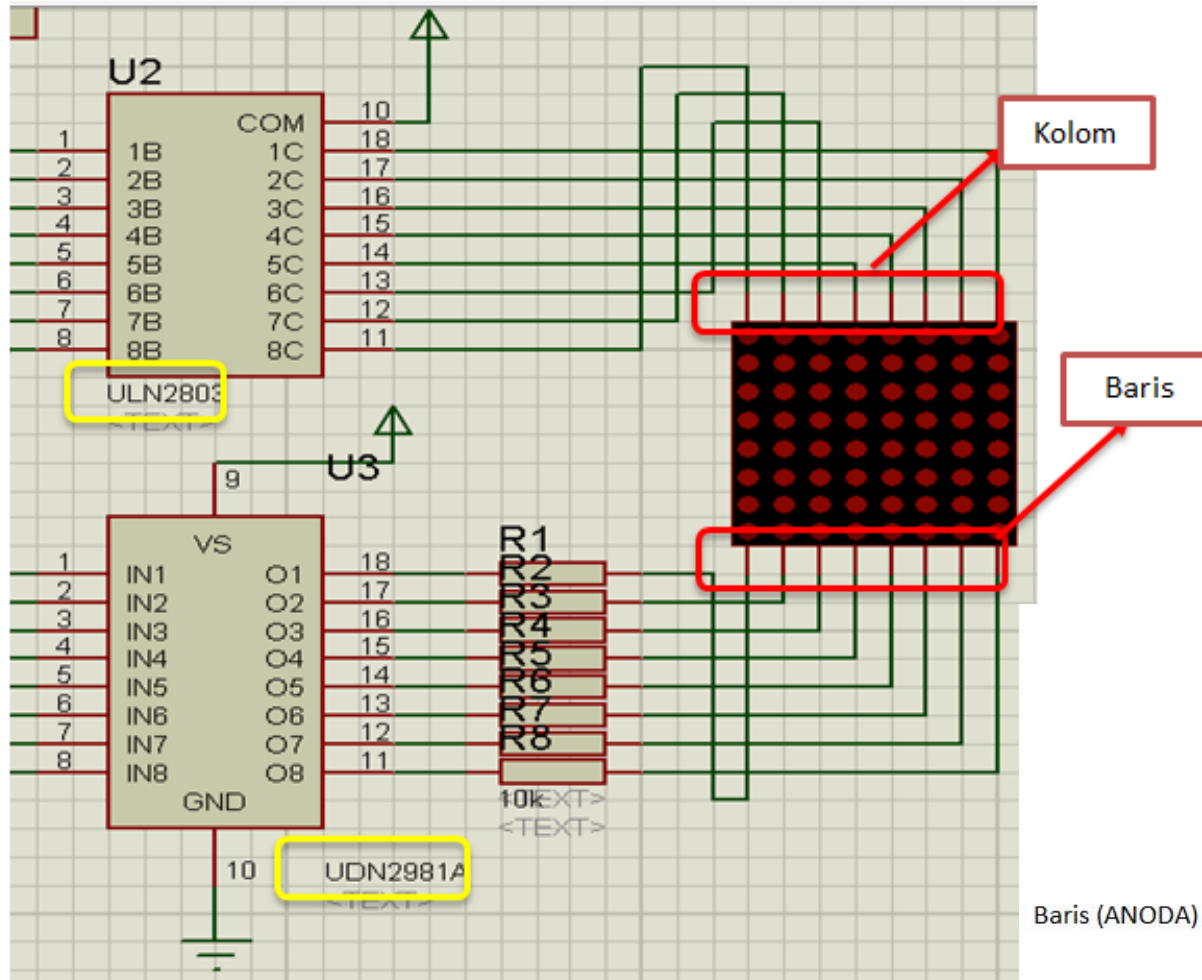


# Rangkaian Interface



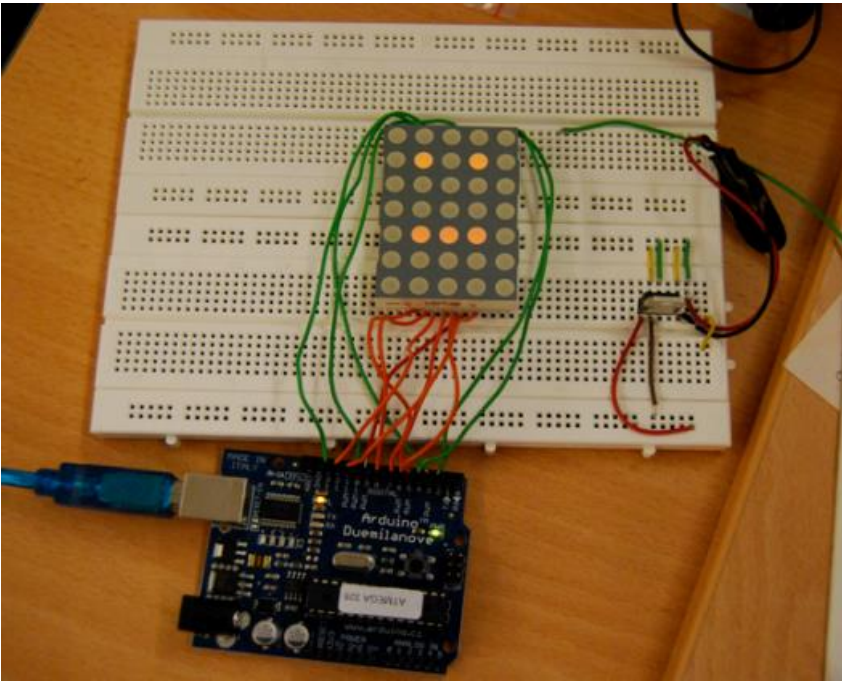


# Rangkaian Interface





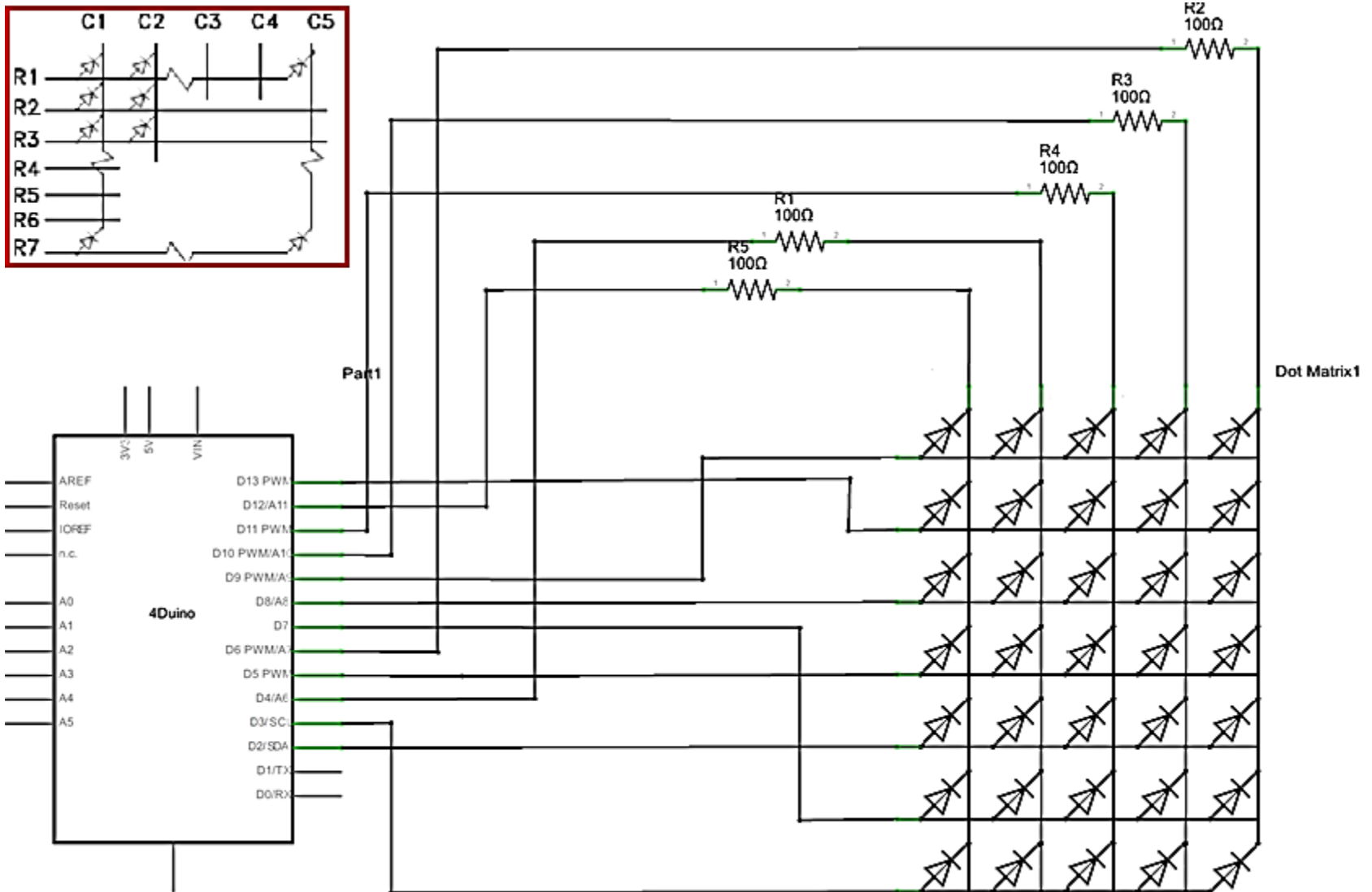
# Rangkaian Interface Dot Matrik 5x7 dengan Arduino



## Hardware :

- Arduino Uno Board
- 1x Breadboard
- 1x LED Dot Matrik 5x7
- Kabel jumper

# Rangkaian Interface Dot Matrik 5x7 dengan Arduino



# Rangkaian Percobaan:

Hubungkan Pin Led Dot Matrik 5x7 ke Pin Arduino sbb:

| <b>PIN LED DOT MATRIK (5x7)</b> | <b>PIN ARDUINO UNO</b> |
|---------------------------------|------------------------|
| <b>R1/9</b>                     | <b>1</b>               |
| <b>R2/14</b>                    | <b>2</b>               |
| <b>R3/8</b>                     | <b>3</b>               |
| <b>R4/12</b>                    | <b>4</b>               |
| <b>R5/1</b>                     | <b>5</b>               |
| <b>R6/7</b>                     | <b>6</b>               |
| <b>R7/2</b>                     | <b>7</b>               |
| <b>C1/13</b>                    | <b>8</b>               |
| <b>C2/3</b>                     | <b>9</b>               |
| <b>C3/11</b>                    | <b>10</b>              |
| <b>C4/10</b>                    | <b>11</b>              |
| <b>C5/6</b>                     | <b>12</b>              |

# ***PROGRAM 1: Nyalakan led per baris***

```
byte r1 = 1; // pin 9
byte r2 = 2; // pin 14
byte r3 = 3; // pin 8
byte r4 = 4; // pin 12
byte r5 = 5; // pin 1
byte r6 = 6; // pin 7
byte r7 = 7; // pin 2
byte c1 = 8; // pin 13
byte c2 = 9; // pin 3
byte c3 = 10; // pin 11
byte c4 = 11; // pin 10
byte c5 = 12; // pin 6

byte columnArray[] = {c1,c2,c3,c4,c5};
byte rowArray[] = {r1,r2,r3,r4,r5,r6,r7};
int i;
```

```
void setup()
{
  for (i=0; i<5; i++)
  {
    pinMode(columnArray[i], OUTPUT);
  }
  for (i=0; i<=7; i++)
  {
    pinMode(rowArray[i], OUTPUT);
  }
}
```

# ***PROGRAM 1: (Lanjutan)***

```
void loop()
{
  for (i=0; i<5; i++)
  {
    digitalWrite(columnArray[i], LOW);
  }
  for (i=0; i<=7; i++)
  {
    digitalWrite(rowArray[i], HIGH); //tes led perbaris
    delay(1000);
    digitalWrite(rowArray[i], LOW);
  }
}
```

# ***PROGRAM 2: Nyalakan semua led***

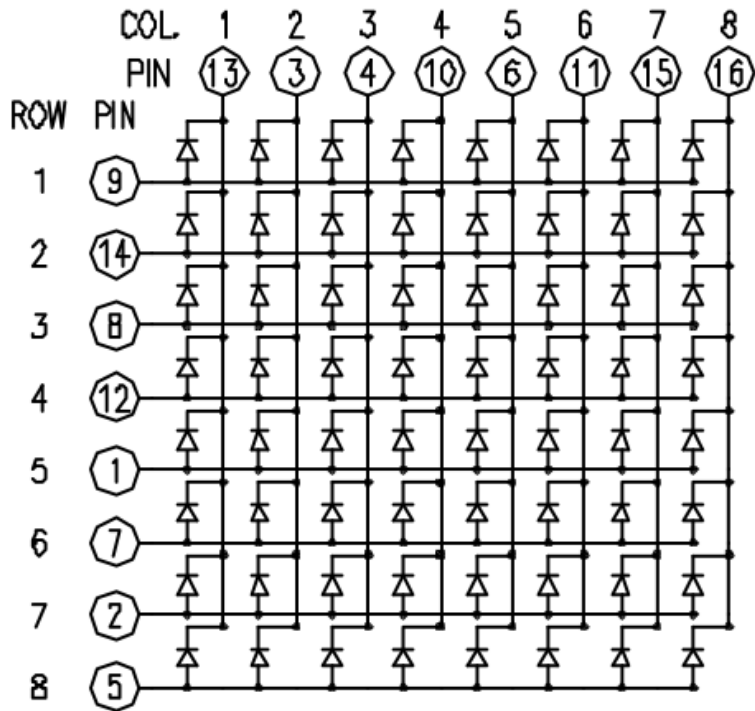
```
byte r1 = 1; byte r2 = 2;
byte r3 = 3; byte r4 = 4;
byte r5 = 5; byte r6 = 6; byte r7 = 7;
byte c1 = 8; byte c2 = 9;
byte c3 = 10; byte c4 = 11; byte c5 = 12;
byte columnArray[] = {c1,c2,c3,c4,c5};
byte rowArray[] = {r1,r2,r3,r4,r5,r6,r7};
int i;

void setup() {
  for (i=0; i<5; i++)
  { pinMode(columnArray[i], OUTPUT); }
  for (i=0; i<=7; i++)
  { pinMode(rowArray[i], OUTPUT); }
}
```

# ***PROGRAM 2: (Lanjutan)***

```
void loop()
{
  for (i=0; i<5; i++)
  {
    digitalWrite(columnArray[i], LOW);
  }
  for (i=0; i<=7; i++)
  {
    digitalWrite(rowArray[i], HIGH); //tes semua led
  }
}
```

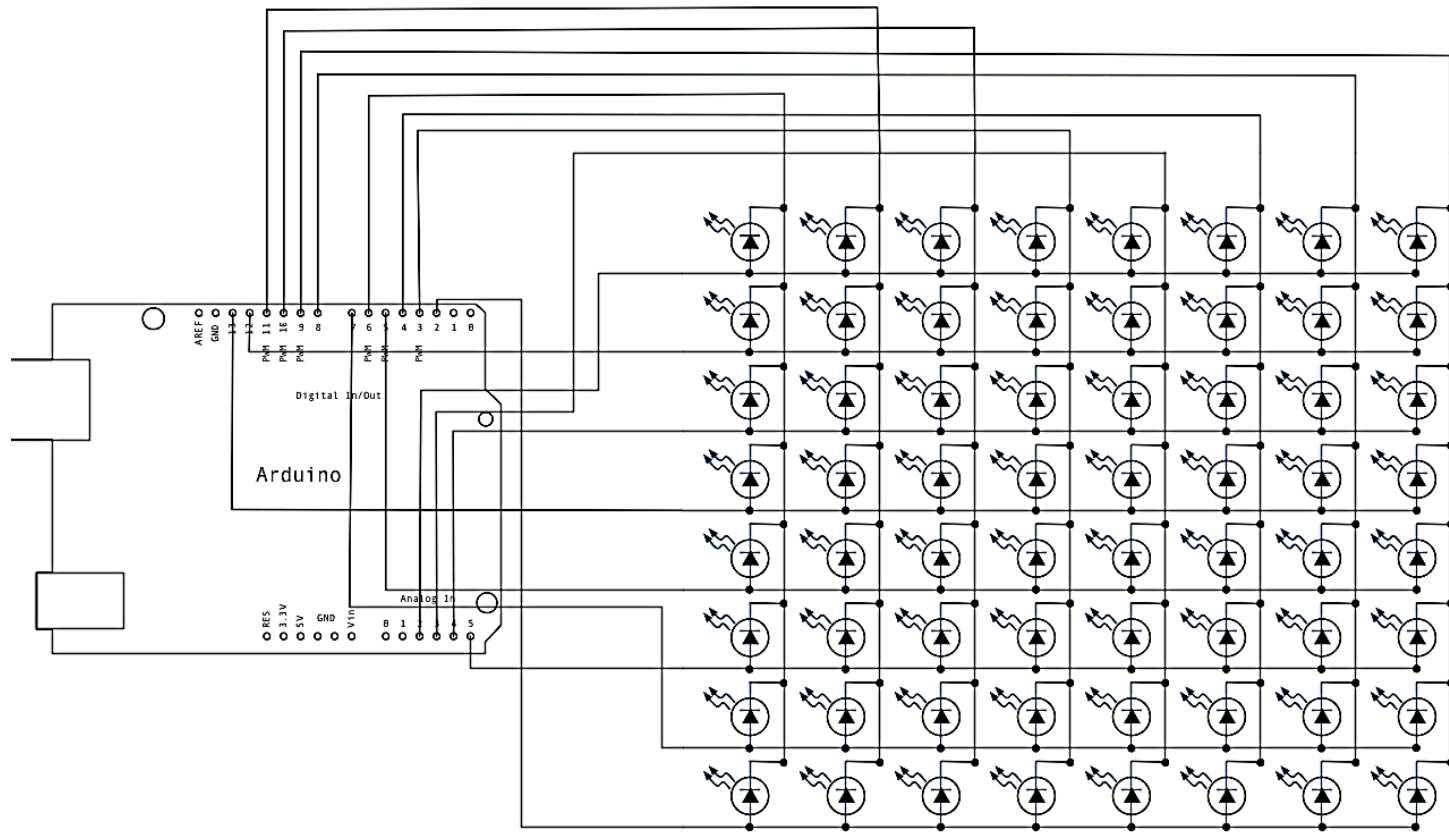
# Rangkaian Interface Dot Matrik 8x8 dengan Arduino



| Matrix pin no. | Row | Column | Arduino pin number |
|----------------|-----|--------|--------------------|
| 1              | 5   | -      | 13                 |
| 2              | 7   | -      | 12                 |
| 3              | -   | 2      | 11                 |
| 4              | -   | 3      | 10                 |
| 5              | 8   | -      | 16 (analog pin 2)  |
| 6              | -   | 5      | 17 (analog pin 3)  |
| 7              | 6   | -      | 18 (analog pin 4)  |
| 8              | 3   | -      | 19 (analog pin 5)  |
| 9              | 1   | -      | 2                  |
| 10             | -   | 4      | 3                  |
| 11             | -   | 6      | 4                  |
| 12             | 4   | -      | 5                  |
| 13             | -   | 1      | 6                  |
| 14             | 2   | -      | 7                  |
| 15             | -   | 7      | 8                  |
| 16             | -   | 8      | 9                  |



# Rangkaian Interface Dot Matrik 8x8 dengan Arduino



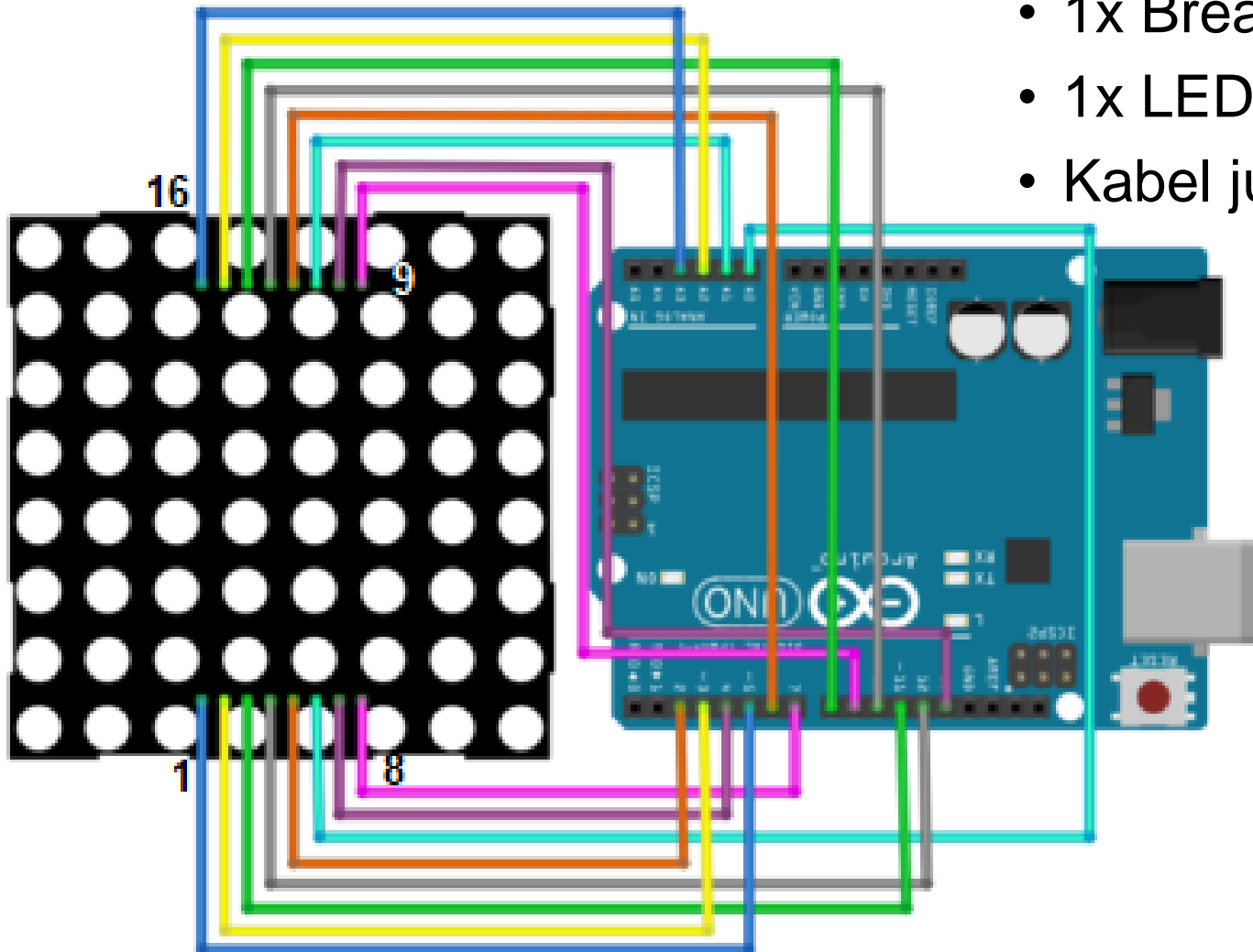
# Rangkaian Percobaan:

Hubungkan Pin Led Dot Matrik 8x8 ke Pin Arduino sbb:

| <b>PIN LED DOT MATRIK (8x8)</b> | <b>PIN ARDUINO UNO</b> |
|---------------------------------|------------------------|
| R1/9                            | 9                      |
| R2/14                           | 8                      |
| R3/8                            | 7                      |
| R4/12                           | 6                      |
| R5/1                            | 5                      |
| R6/7                            | 4                      |
| R7/2                            | 3                      |
| R8/5                            | 2                      |
| C1/13                           | 10                     |
| C2/3                            | 11                     |
| C3/4                            | 12                     |
| C4/10                           | 13                     |
| C5/6                            | A0                     |
| C6/11                           | A1                     |
| C7/15                           | A2                     |
| C8/16                           | A3                     |

# Rangkaian Percobaan:

- Arduino Uno Board
- 1x Breadboard
- 1x LED Dot Matrik 8x8
- Kabel jumper



# ***PROGRAM-1: Nyalakan led per baris***

```
#define ROW_1 9
#define ROW_2 8
#define ROW_3 7
#define ROW_4 6
#define ROW_5 5
#define ROW_6 4
#define ROW_7 3
#define ROW_8 2

#define COL_1 10
#define COL_2 11
#define COL_3 12
#define COL_4 13
#define COL_5 A0
#define COL_6 A1
#define COL_7 A2
#define COL_8 A3
```

```
int i;
void setup()
{
  for (i=0; i<=7; i++)
  {
    pinMode(col[i], OUTPUT);
  }
  for (i=0; i<=7; i++)
  {
    pinMode(rows[i], OUTPUT);
  }
}
```

```
const byte rows[] = { ROW_1, ROW_2, ROW_3, ROW_4, ROW_5, ROW_6, ROW_7, ROW_8 };
const byte col[] = { COL_1, COL_2, COL_3, COL_4, COL_5, COL_6, COL_7, COL_8 };
```

# ***PROGRAM-1: lanjutan***

```
void loop()
{
  for (i=0; i<=7; i++)
  {
    digitalWrite(col[i], LOW);
  }
  for (i=0; i<=7; i++)
  {
    digitalWrite(rows[i], HIGH); //tes led perbaris
    delay(1000);
    digitalWrite(rows[i], LOW);
  }
}
```

# ***PROGRAM-2: Nyalakan semua led***

```
#define ROW_1 9
#define ROW_2 8
#define ROW_3 7
#define ROW_4 6
#define ROW_5 5
#define ROW_6 4
#define ROW_7 3
#define ROW_8 2

#define COL_1 10
#define COL_2 11
#define COL_3 12
#define COL_4 13
#define COL_5 A0
#define COL_6 A1
#define COL_7 A2
#define COL_8 A3
```

```
int i;
void setup()
{
  for (i=0; i<=7; i++)
  {
    pinMode(col[i], OUTPUT);
  }
  for (i=0; i<=7; i++)
  {
    pinMode(rows[i], OUTPUT);
  }
}
```

```
const byte rows[] = { ROW_1, ROW_2, ROW_3, ROW_4, ROW_5, ROW_6, ROW_7, ROW_8 };
const byte col[] = { COL_1, COL_2, COL_3, COL_4, COL_5, COL_6, COL_7, COL_8 };
```

# ***PROGRAM-2: lanjutan***

```
void loop()
{
  for (i=0; i<=7; i++)
  {
    digitalWrite(col[i], LOW);
  }
  for (i=0; i<=7; i++)
  {
    digitalWrite(rows[i], HIGH); //tes semua led
  }
}
```

## ***Hasil :***

- Catat dan foto hasil data yang tampil di LED Dot Matrik
- Buat laporan hasil dari percobaan

## ***Latihan :***

1. Buatlah program untuk tulisan A berjalan dari kiri ke kanan.
2. Buatlah program untuk menampilkan 2,T,A,B
3. Buatlah program dua angka paling belakang dari NRP.
4. Buatlah program untuk menampilkan karakter menggunakan IC Driver



# Latihan :

5. Buatlah tampilan sebagai berikut:

a.



b.

