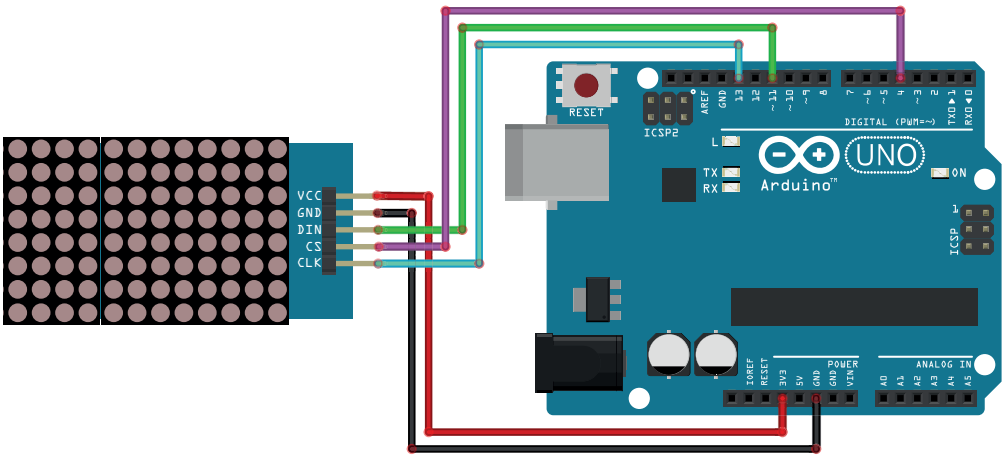
MAX7219 LED Matrix

- Connecting an MAX7219 LED matrix to your Arduino
- Scrolling text, addressing individual LEDs, simple graphics

1. Wiring diagram



Pin connections

Max7219	Arduino
VCC	3.3v
GND	GND
DIN	D11*
CS	D4
CLK	D13*

* Note that DIN and CLK must be connected to digital pins 11 and 13 respectively

- Ensure you connect to the correct end of the module - the digital in pin will be labelled DIN.
- LED matrices are usually in 8 x 8 LED blocks. It is common for four blocks to be on one module, creating a 32 x 8 block
- Modules can be "daisy-chained" to create even longer displays. Connect DOUT on the first module to DIN on the next

2. Install the library

- From your Arduino IDE, go to the **Tools** menu, then select **Manage Libraries...**
- Search for **"Simple LED Matrix"**. There are lots of libraries with similar names, so ensure you select the one by **Jamai Bouajjaj**
- Click the **Install** button. Once installed, close the Library Manager

3. Adding static and scrolling text

```
1.  #include <font.h>
2.  #include <simple_matrix.h>
3.
4.  const int clockPin = 4;
5.  simpleMatrix disp(clockPin, true);
6.
7.  void setup() {
8.    disp.begin();
9.    disp.setIntensity(0x0f);
10. }
11.
12. void loop() {
13.   disp.scrollText("Scroll text left", 40);
14.   delay(2000);
15.   disp.print("Static text");
16.   delay(2000);
17. }
```

Import libraries

Our program uses Arduino pin 4 for the clock.
We will use **disp** as the library's object name. If the text on the display is oriented incorrectly, change **true** to **false**

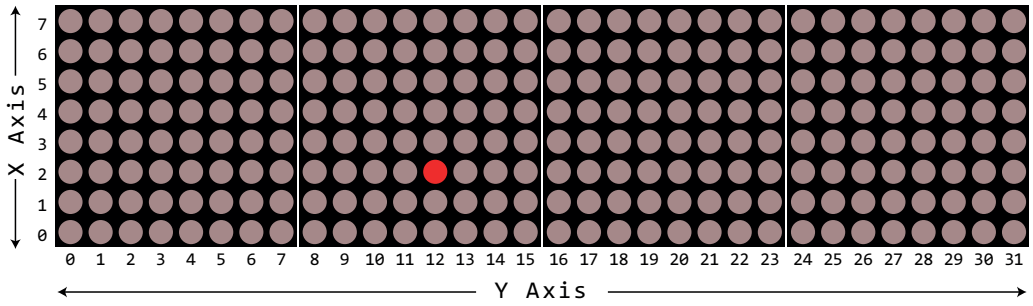
Set the display's brightness using a hexadecimal value.
`0x00` = 0 (darkest) to `0x0f` = 15 (brightest)

Scroll the String towards the left at a speed of 40

Display static text. If the String is too long, the right of it will be cut-off

4. Addressing individual LEDs

- The library allows us to turn specific LEDs on or off
- LEDs are addressed on an X and Y axis
- **Note:** in our program, Y is horizontal and X is vertical. Your module may differ
- The LED lit below is at coordinates (2, 12)



Lines 1 - 11 of this program are the same as the previous one. To save space here, they have been omitted

```
12. void loop() {
13.   for (int y = 0; y < 32; y++){
14.     disp.setPixel(0, y);
15.     delay(100);
16.   }
17.
18.   for (int y = 0; y < 32; y++){
19.     disp.clearPixel(0, y);
20.     delay(100);
21.   }
22. }
```

Turn on each of the LEDs along the bottom row, one at a time...

...and then turn them off again

5. Scrolling graphics

- We can also display or scroll bitmap graphic images
- Images are stored as binary data (`1` = on, `0` = off) in an array
- Each line of the array contains the data for one column of the display
- It is a good idea to draw your image on square paper before converting it to binary

```
1.  #include <simple_matrix.h>
2.  uint8_t Bitmap[] = {
3.    0b00111100,
4.    0b01000010,
5.    0b10101001,
6.    0b10000101,
7.    0b10000101,
8.    0b10101001,
9.    0b01000010,
10.   0b00111100
11. };
12. uint8_t numberofcolumns = (sizeof(Bitmap) / sizeof(Bitmap[0]));
13.
14. const int clockPin = 4;
15. simpleMatrix disp(clockPin, true);
16.
17. void setup() {
18.   disp.begin();
19.   disp.setIntensity(0x0f);
20. }
21. void loop() {
22.   disp.sendColumnBuffer(Bitmap, numberofcolumns, 0);
23.   delay(1000);
24.   disp.scrollBuffer(Bitmap, 20, numberofcolumns);
25.   delay(1000);
26. }
```

- Each row of the array represents a column of the display
- The image can be longer than the display
- `0b` at the start of each number tells the computer that it is using a binary number
- Can you work out what the image is of?

Calculate and store the number of elements in the array

Show the bitmap. The 0 is the start position of the image

Scroll the bitmap. 20 is the duration of the scroll (lower numbers = faster scroll