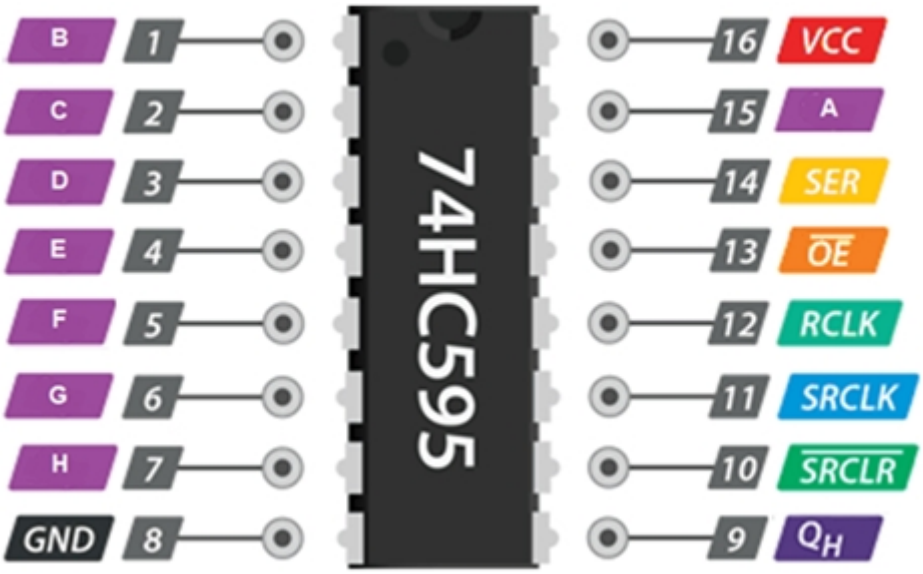
STEMKRAF - 74HC595 (Shift Register with 8-bit OUTPUT)
https://github.com/teaksoon/stemkraf

Each 74HC595 Shift Register IC provides 8 digital output from a single micro-controller digital output pin. Each 74HC595 chip can be “chained” to another 74HC595 chip. That means we can have multiples of 8 additional digital output pins from each “chained” 74HC595chip. 1chip=8output, 2chips=16output, 3chips=24output and so on...



GND - To Arduino GND
VCC - To Arduino VCC
A to H - Each Pin is connected to one digital output device

SER - Connect to any Arduino Pin (only for first chip in multiple chips setup). To be set from our program to either HIGH or LOW. This will be moved into A when shifted.

SRCLK - Connect to any Arduino Pin
Used with SER, starts with LOW. **When SRCLK is changed from LOW to HIGH**, bit **shifting** happens, H moves to QH (G to H, F to G,... A to B), finally the bit **SER moves into A**

RCLK - Connect to any Arduino Pin
Used with A to H. Start with LOW, **When RCLK is changed from LOW to HIGH**, The **A-H state(LOW or HIGH) is available to all the the output device** connected to each of them

QH - Buffer for multiple chained chips operation
The bit that got "shifted-out“ by SRCLK (bit H), comes here. **To be connected to the next 74HC595 chip’s SER Pin**

SRCLR - Clear entire Shift Register
When SRCLR is set to LOW, the entire Shift Register will be cleared. Normally we dont need to use this, so **we just connect to VCC(which is always HIGH).** If required, connect to any Arduino Pin

OE - Enable or Disable A to H
When set to HIGH, A to H will be disabled. When OE is set to LOW, A-H will be enabled. Since we normally used them as enabled, **we just connect to GND(which is always LOW).** If required, connect to any Arduino Pin

For multiple chips, they shares the **same SRCLK, RCLK** Arduino pin

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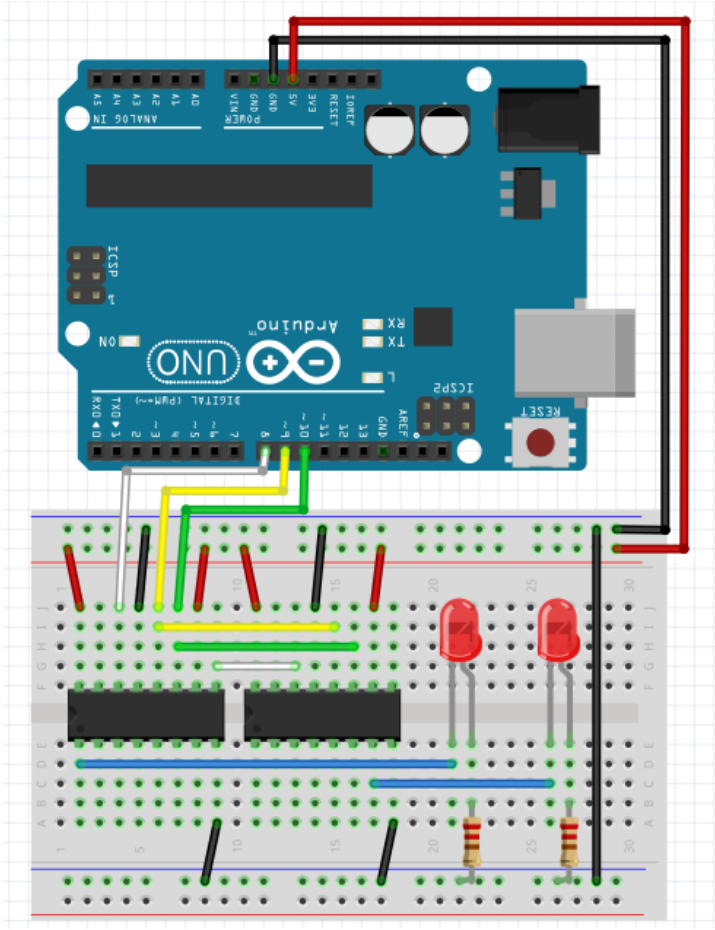
Program: **stemkraf_74HC595**
(1/2): test program for 74HC595
:
: by TeakSoon Ding for STEMKRAF (NOV-2021)



Hardware:
1x Arduino Uno
1x Solderless Breadboard

Jumper wires

2x 5mm LED
2x Resistor 220ohm

2x 74HC595 Shift Register

Each 74HC595 chip have 8 Output pins. This setup has two 74HC595 chips. This means we will have 16 Output pins for our Digital Output device. In this setup, we have two 2 LED attached to one pin on each chip for Output. We have 14 unused Output pins.

The number Arduino Uno pin used will be the same for 1 chip or multiple chained chips. We will need 3 arduino pin to 1 chip, to get 8 Ouput pins, if we have 2 chips, we still use the same 3 arduino pin to get 16 Output pins, if we use 10 chips we also use the same 3 arduino pin to get 80 Output pins

Each chip has Input pin labelled as A to H, you can connect any Digital Output device to each of them. Since all chips have pin A to H, when we use multiple chips, it is easier to use an index numbering system. Later we just use the index access to any of them by running a function. For example: **sreg_set_state(15, HIGH)** to set the Output Device connected to **Chip 2, pin H, to receive HIGH value**

Chip 1: A = 0 Chip 2: A = 8 Chip 3: A = 16
Chip 1: B = 1 Chip 2: B = 9 Chip 3: B = 17
Chip 1: C = 2 Chip 2: C = 10 ...
Chip 1: D = 3 Chip 2: D = 11 ...
Chip 1: E = 4 Chip 2: E = 12 ...
Chip 1: F = 5 Chip 2: F = 13 ...
Chip 1: G = 6 Chip 2: G = 14 ...
Chip 1: H = 7 **Chip 2: H = 15** ...

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```
Program: stemkraf_74HC595
  (2/2): test program for 74HC595
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```
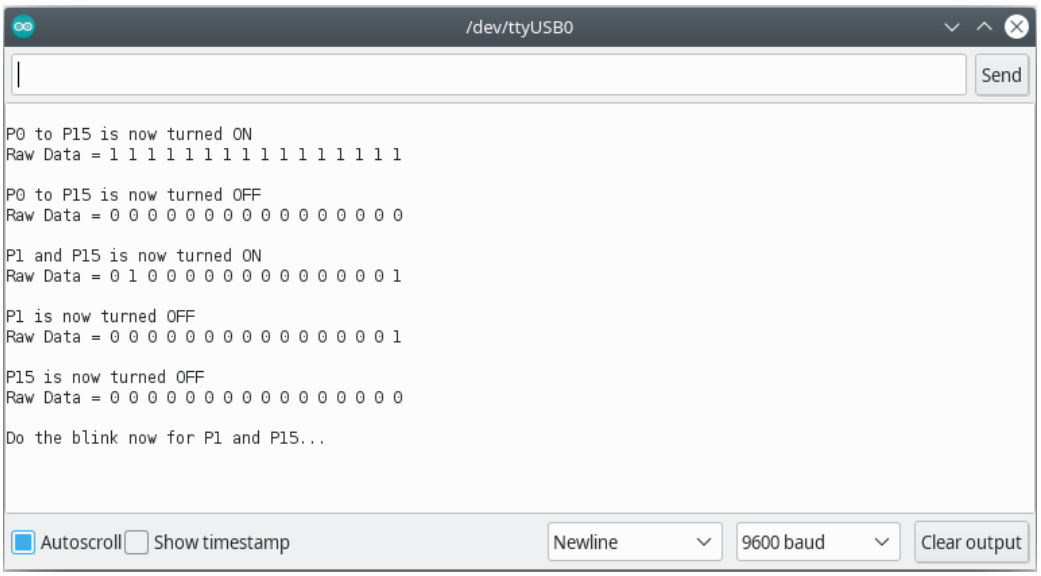

- Upload this program with the Arduino IDE Software
- Open up the Serial Monitor from the Arduino IDE Software
- Watch the LED and the Serial Monitor Screen



Each output is reference by a pin index position(iPos), starting from 0 to 7 for the first chip, second chained chip 8 to 15, third chained chip 16 to 23 and so on...

8-bits for each chip. 1-bit is one index position.

There are 2 main function in this program.

sreg_set_state(iPos, pinState) - this function will set the bits for individual shift register Output Pins. It stores data in a global array **sreg**, wont be reflected in connected device until we run the **sreg_74hc595_write()** function

iPos = 0 to ... (max iPos depends on number of chips connected)
pinState = HIGH or LOW

sreg_74hc595_write() - this function will read from the global array, **sreg** and set all the Output devices with the state of all the Output Pins stored in the **sreg** array, all at one go.

This program uses an 8-bit (one byte) array for working storage, this is to easily manage the chained chips. Each byte (8-bit) in the array is for each Chip (8-Pin).

To have more chips, we only need to change #define TOTAL_CHIP in this program