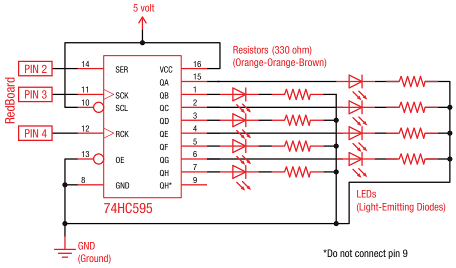
CIRCUIT #14

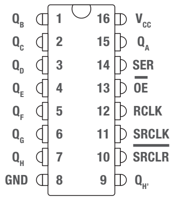
14

Shift Register

Now we are going to step into the world of ICs (integrated circuits). In this circuit, you'll learn all about using a shift register (also called a serial-to-parallel converter). The shift register will give your RedBoard an additional eight outputs, using only three pins on your board. For this circuit, you'll practice by using the shift register to control eight LEDs.

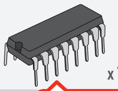
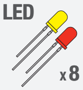
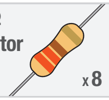
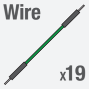


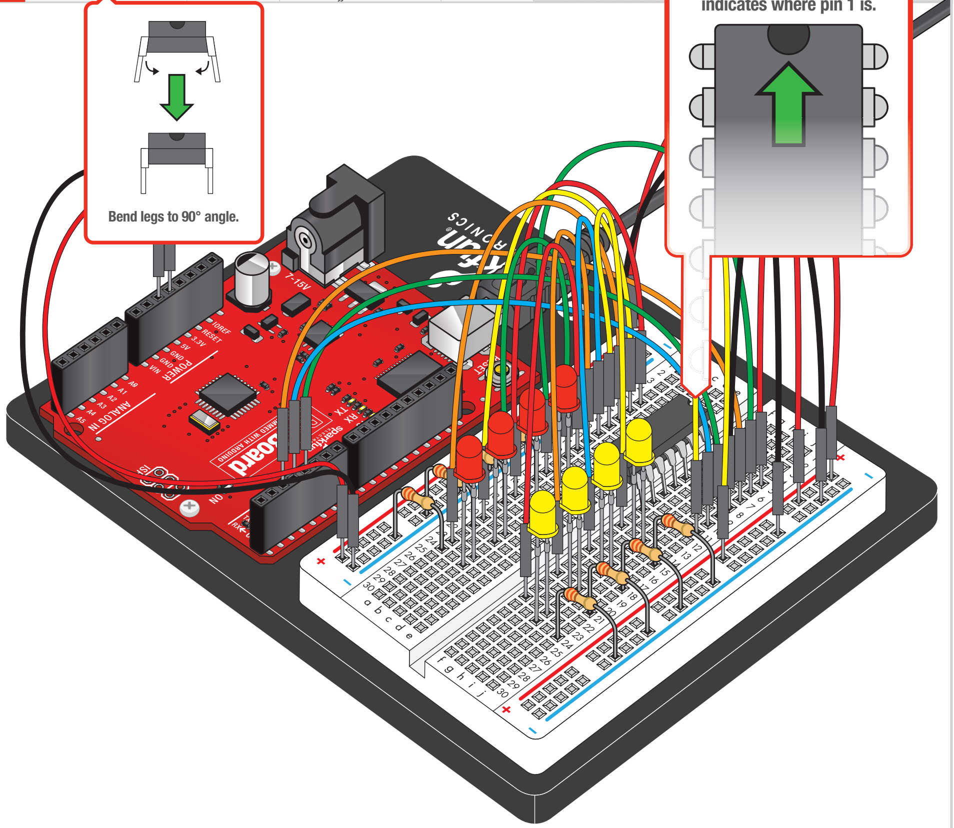
*Do not connect pin 9

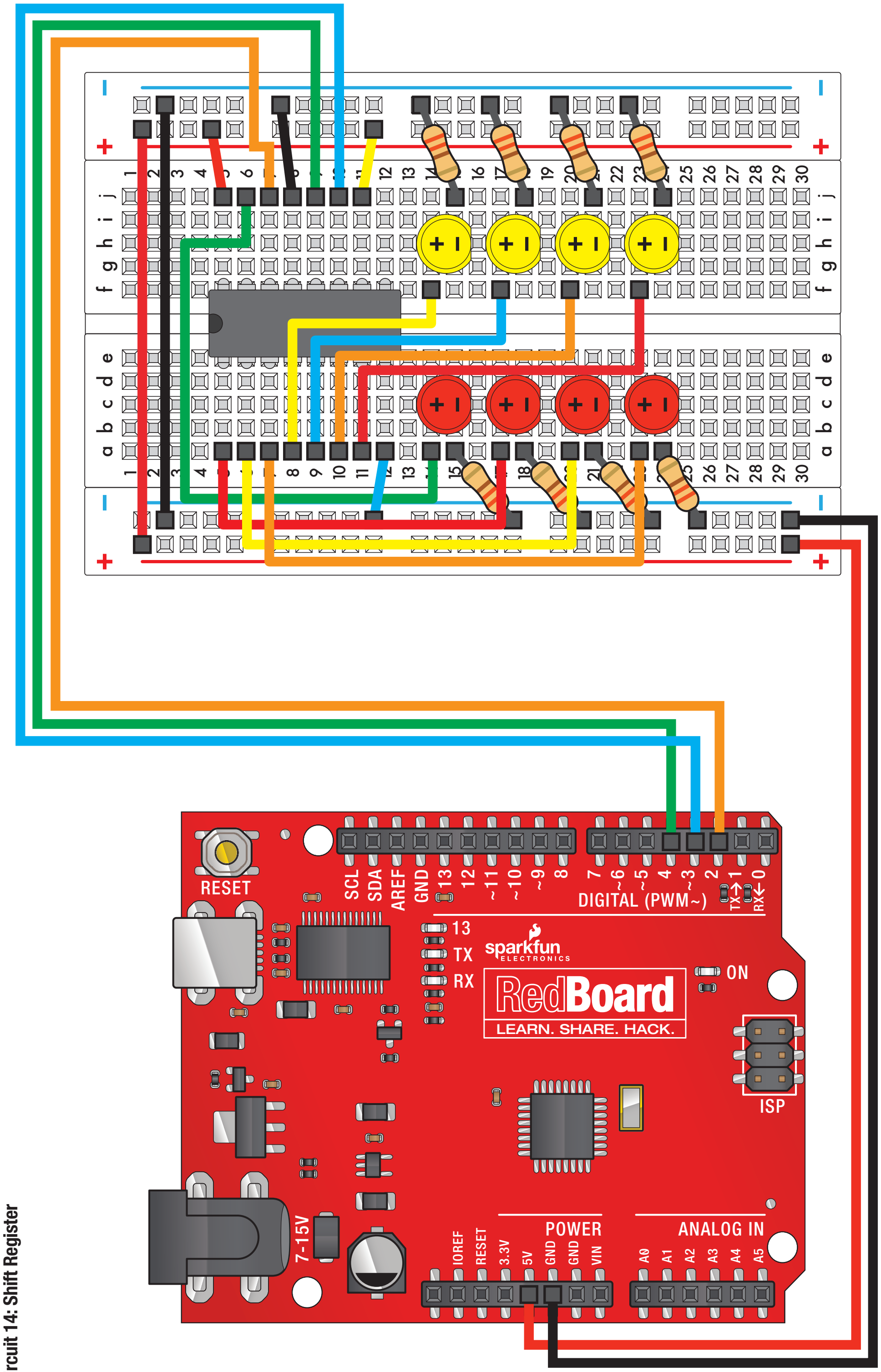


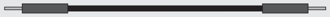
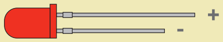
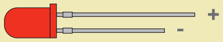
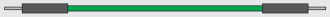
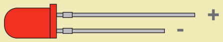
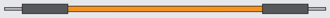
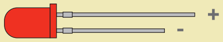
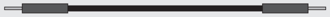
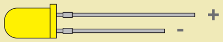
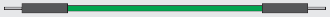
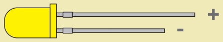
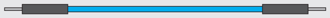
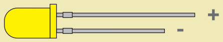
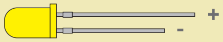
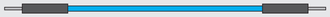
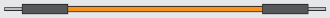
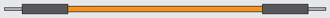
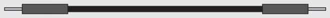
Align notch on top, inbetween "e5" and "f5" on the breadboard. The notch indicates where pin 1 is.

PARTS:

IC	LED	330Ω Resistor	Wire
			
x 1	x 8	x 8	x19




a b c d e
f g h i j
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
+
-
RESET
SCL
SDA
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
DIGITAL (PWM~)
13
TX
RX
sparkfun
ELECTRONICS
RedBoard
LEARN. SHARE. HACK.
ON
ISP
7-15V
POWER
IOREF
RESET
3.3V
5V
GND
GND
VIN
ANALOG IN
A0
A1
A2
A3
A4
A5

Component:	Image Reference:	■	□	Component:	Image Reference:	■	□
IC ⚠			e5 e6 e7 e8 e9 e10 e11 e12 f5 f6 f7 f8 f9 f10 f11 f12	Jumper Wire		▨	- – -
LED (5mm) ⚠		▨	c14 c15 + -	Jumper Wire		▨	j5 – +
LED (5mm) ⚠		▨	c17 c18 + -	Jumper Wire		▨	j6 – a14
LED (5mm) ⚠		▨	c20 c21 + -	Jumper Wire		Pin 2	j7
LED (5mm) ⚠		▨	c23 c24 + -	Jumper Wire		▨	j8 – -
LED (5mm) ⚠		▨	h14 h15 + -	Jumper Wire		Pin 4	j9
LED (5mm) ⚠		▨	h17 h18 + -	Jumper Wire		Pin 3	j10
LED (5mm) ⚠		▨	h20 h21 + -	Jumper Wire		▨	j11 – +
LED (5mm) ⚠		▨	h23 h24 + -	Jumper Wire		▨	f14 – a8
330Ω Resistor		▨	- – a15	Jumper Wire		▨	f17 – a9
330Ω Resistor		▨	- – a18	Jumper Wire		▨	f20 – a10
330Ω Resistor		▨	- – a21	Jumper Wire		▨	f23 – a11
330Ω Resistor		▨	- – a24	Jumper Wire		▨	a23 – a7
330Ω Resistor		▨	j15 – -	Jumper Wire		▨	a20 – a6
330Ω Resistor		▨	j18 – -	Jumper Wire		▨	a17 – a5
330Ω Resistor		▨	j21 – -	Jumper Wire		5V	+
330Ω Resistor		▨	j24 – -	Jumper Wire		GND	-
Jumper Wire		▨	+ – +				

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Arduino Code:

Open Arduino IDE // File > Examples > SIK Guide > Circuit # 14

Code to Note:

`shiftOut(datapin, clockpin, MSBFIRST, data);`

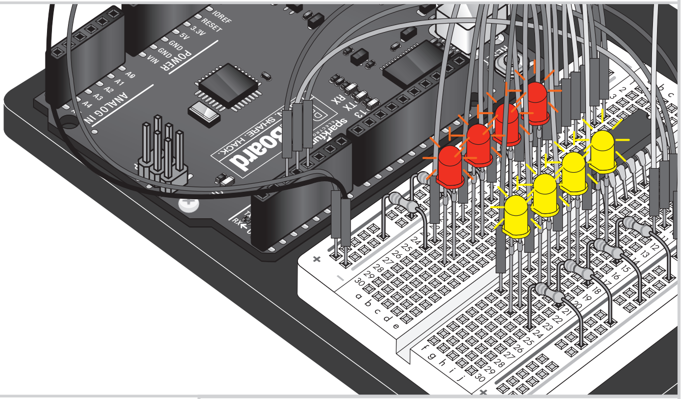
You'll communicate with the shift register (and a lot of other parts) using an interface called SPI, or Serial Peripheral Interface. This interface uses a data line and a separate clock line that work together to move data in or out of the RedBoard at high speed. The MSBFIRST parameter specifies the order in which to send the individual bits, in this case we're sending the Most Significant Bit first.

`bitWrite(byteVar, desiredBit, desiredState);`

Bits are the smallest possible piece of memory in a computer; each one can store either a "1" or a "0". Larger numbers are stored as arrays of bits. Sometimes we want to manipulate these bits directly, for example now when we're sending eight bits to the shift register and we want to make them 1 or 0 to turn the LEDs on or off. The RedBoard has several commands, such as bitWrite(), that make this easy to do.

What You Should See:

You should see the LEDs light up similarly to circuit 4 (but this time, you're using a shift register). If they aren't, make sure you have assembled the circuit correctly and verified and uploaded the code to your board. See the troubleshooting tips below.



Troubleshooting:

The RedBoard's power LED goes out
This happened to us a couple of times, it happens when the chip is inserted backward. If you fix it quickly nothing will break.

Not Quite Working
Sorry to sound like a broken record but it is probably something as simple as a crossed wire.

Frustration
Shoot us an e-mail, this circuit is both simple and complex at the same time. We want to hear about problems you have so we can address them in future editions: **techsupport@sparkfun.com**

Real World Application:

Similar to circuit #4, a scrolling marquee display delivers a message with multiple LEDs. Essentially the same task the shift register achieves here in Circuit #14.