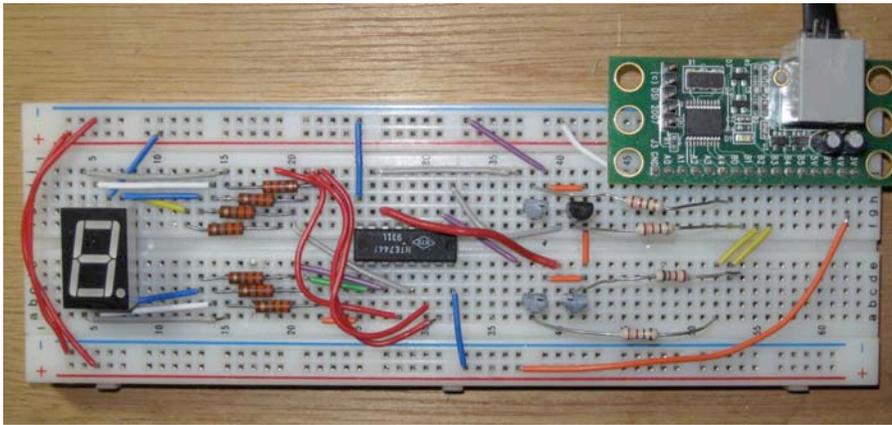


## Project: NXT Output=>HiTechnic Prototype Board=>7 Segment Display



*Make no assumptions when connecting untested homemade peripherals to your NXT. The risks to do damage to yourself or your NXT should be carefully considered before attempting any project. The following information is based on my observations and experimentations. Your results may be different.*

This single digit display was the direct result from efforts to clean out my junk parts inventory; not some grand design to create a clever piece of circuitry. It would be far simpler to display the digit on the NXT screen using the display block. Yet I can imagine this becoming part of a much larger circuit (someday).

The heart of the circuit is the “Binary Coded Decimal (BCD) to Seven Segment Decoder/Driver”. The Binary number system requires 4 bits (B0 – B3 of the HiTechnic Prototype Board) to represent a number between 0 – 9. A BCD requires 4 bits for the first digit, 4 bits for the second digit and so on.

On the 7447 chip the active levels are low or, without an input signal the logic levels will be True (1) and the inputs must be grounded to achieve a False (0) logic level. The transistors (T1- T4) are used as switches that ground the chip’s inputs when they are turned on. Therefore, a True output from the Prototype Board turns on the transistor that causes a false logic level. The binary 4-bit digit needs to be inverted before it is used to set the Prototype board’s outputs. Once the inputs are set, a bunch of internal inverts and logic gates are used to turn on the proper segment of the display. (Some data sheets contain the logic diagram)

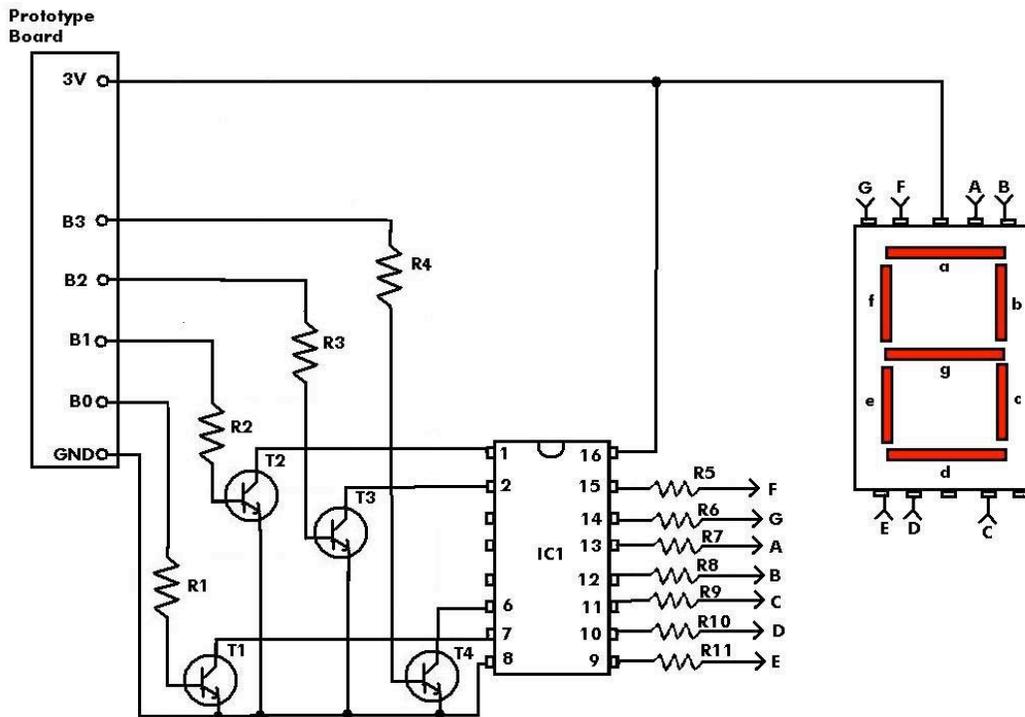
So, to display the number 4, the digit starts in the NXT as 0100 binary. The 0100 must be inverted to 1011. In binary that’s  $1111 - 0100 = 1011$  ( $15 - 4 = 11$  decimal). A Binary Write block is used to set the pins to 1011. The ones turn on the transistors that ground the 7447 inputs causing the logic levels in the chip to become 0100 (back to 4). The chip takes over and turns on segments b, c, f and g.

My circuit operates using the 3V pin. It is below the supply voltage (Vcc) minimum specification of 4.5V. You may want to use the 4V pin. The LEDs do get brighter when the 4V pin is used. Vcc should not exceed 7V.

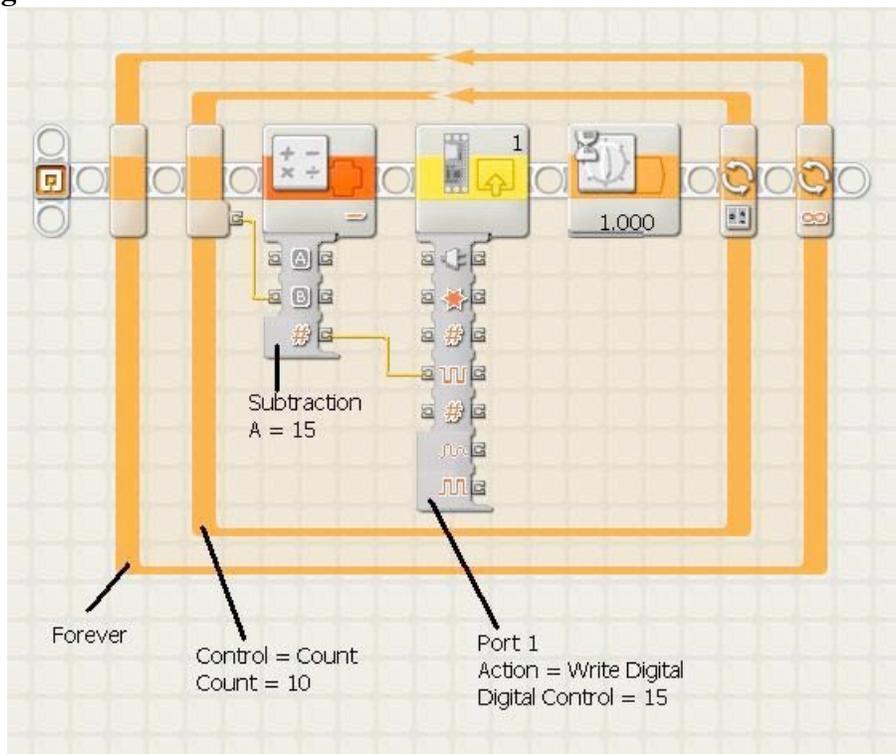
### Materials

Parts		Quantity	Note
	HiTechnic Prototype Board	1	
R1 – R4	220 ohm resistor	4	
R5 – R11	330 ohm resistor	7	
T1 – T4	2n2222 NPN transistor	4	
IC1	7447 - Binary Coded Decimal To 7 Segment decoder/driver	1	
LED 1	Seven Segment Display – Common Anode	1	See text

I was not able to verify the availability of the Seven Segment Display shown in the photos. The one shown is from China Semiconductor, part number CSS-154R. It is .5" tall, Red and has a common anode. When deciding which display to use be sure that it has a common anode. The wiring will need to be changed to conform to your display's pin configuration.



## Test Program



This NXT-G program counts from 0 to 9 and sets the display. Then starts over until the stop button is pressed.

### Final note

I wasn't able to finish this write up without speculating on how I might change the circuit or modify it to make it useful.

If you have the HiTechnic Prototype Board, you should be able to purchase the parts for under \$10.00. It would cost less, but if resistors can be purchased for 1.5 cents each, you still have to order 100. The seven-segment display is the most expensive part and will depend on how large you want it.

My parts were left over from a project that used the 4 joystick ports on the Atari 800 computer to drive 4 displays to make a digital clock. I was able to get the clock to work and it even hung on the wall of my office for a few weeks.