

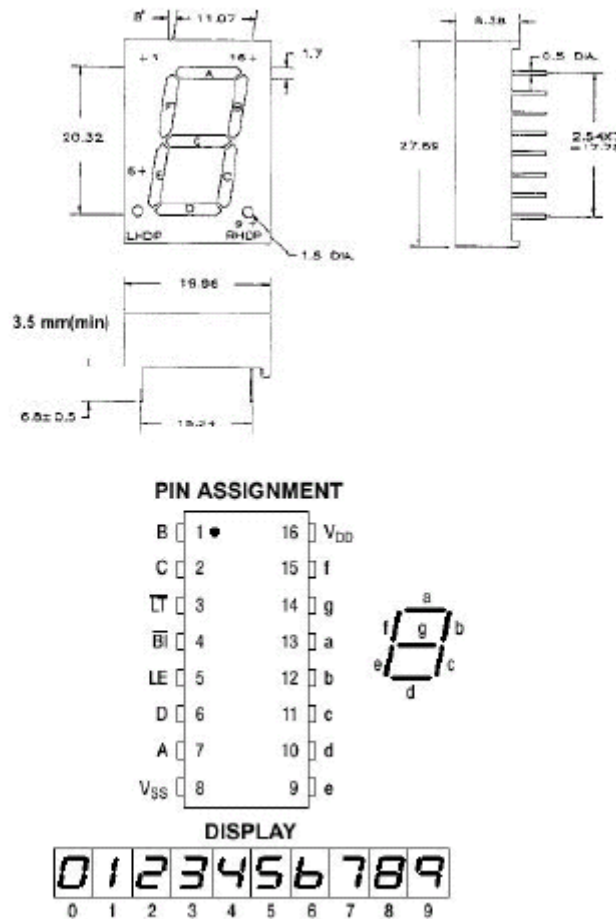
Lecture 7. Digital Display

Binary numbers are necessary, but very hard to read or interpret.

What is available to display binary to decimal information?

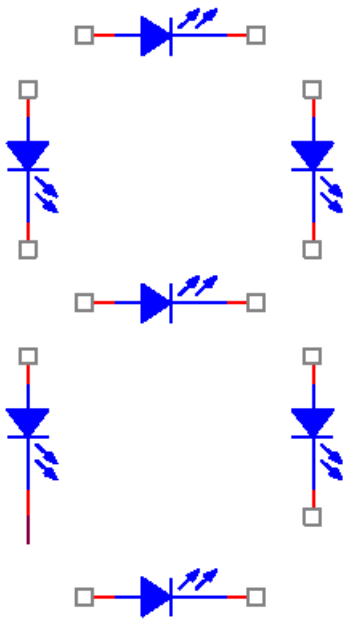
A seven-segment L.E.D. display.

A seven-segment display may have 7, 8, or 9 leads on the chip. Usually leads 8 and 9 are decimal points. The figure below is a typical component and pin layout for a seven segment display.



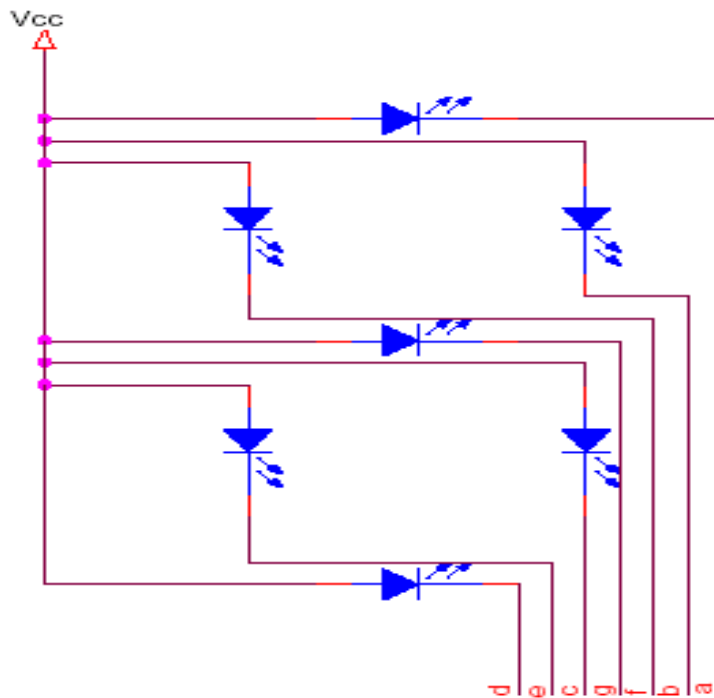
7 SEGMENT DISPLAY

The light emitting diodes in a seven-segment display are arranged in the figure below.



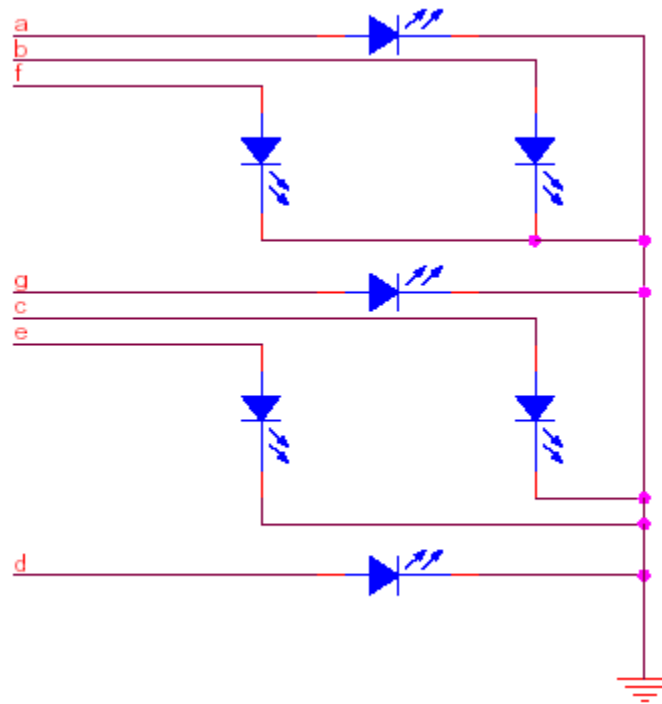
DIODE PLACEMENT IN A SEVEN SEGMENT DISPLAY, NO DECIMAL

There are two types of displays available, common anode and common cathode. The wiring for a common anode is shown below.



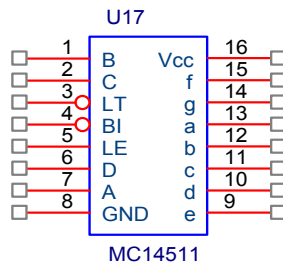
COMMON ANODE INTERNAL WIRING

The wiring for the common cathode is shown below.



COMMON CATHODE INTERNAL WIRING

To convert the binary numbers to signals that can drive the L.E.D.s in the display you need a display driver. In the lab we use an MC14511 chip. The pinouts are shown below.



PINOOTS FOR THE MC14511 SEVEN-SEGMENT DISPLAY DRIVER

- A, B, C, and, D are the binary inputs.
- a, b, c, d, e, f, and g are the driver signals to the display elements.
- LT is the Light Test control, turns all segments on, active low.
- BL blanks all the segments when activated, active low.
- LE is the latch enable control.

The truth table shown below is used to confirm that the digital signal sent to the display lights up the correct segment.

TRUTH TABLE

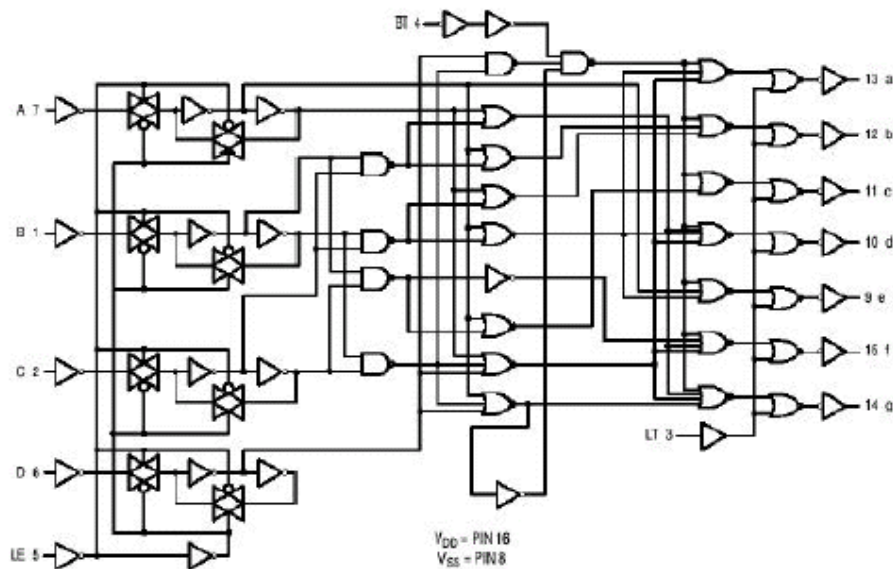
Inputs				Outputs										
LE	BI	LT	D	C	B	A	a	b	c	d	e	f	g	Display
X	X	0	X	X	X	X	1	1	1	1	1	1	1	8
X	0	1	X	X	X	X	0	0	0	0	0	0	0	Blank
0	1	1	0	0	0	0	1	1	1	1	1	1	0	0
0	1	1	0	0	0	1	0	1	1	0	0	0	0	1
0	1	1	0	0	1	1	1	1	1	1	0	0	1	2
0	1	1	0	0	1	1	1	1	1	1	0	0	1	3
0	1	1	0	1	0	0	0	1	1	0	0	1	1	4
0	1	1	0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	1	0	0	0	1	1	1	1	1	6
0	1	1	0	1	1	1	1	1	1	0	0	0	0	7
0	1	1	1	0	0	0	1	1	1	1	1	1	1	8
0	1	1	1	0	0	1	1	1	1	0	0	1	1	9
0	1	1	1	0	1	0	0	0	0	0	0	0	0	Blank
0	1	1	1	0	1	1	0	0	0	0	0	0	0	Blank
0	1	1	1	1	0	0	0	0	0	0	0	0	0	Blank
0	1	1	1	1	0	1	0	0	0	0	0	0	0	Blank
0	1	1	1	1	1	0	0	0	0	0	0	0	0	Blank
0	1	1	1	1	1	1	0	0	0	0	0	0	0	Blank
1	1	1	X	X	X	X				*				*

X = Don't Care

*Depends upon the BCD code previously applied when LE = 0

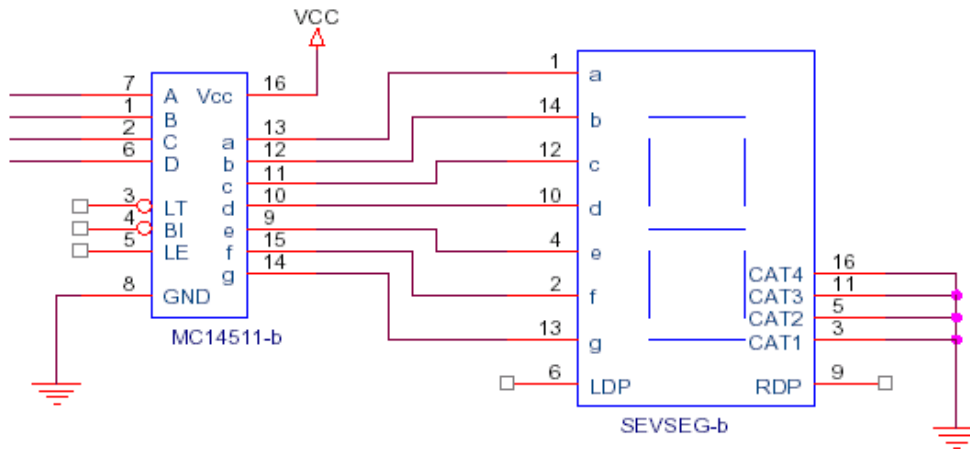
TRUTH TABLE FOR THE SEVEN-SEGMENT DISPLAY

The internal circuitry and logic gates for the display is shown below.



INTERNAL CIRCUITRY AND LOGIC GATES FOR 7 SEG DISPLAY

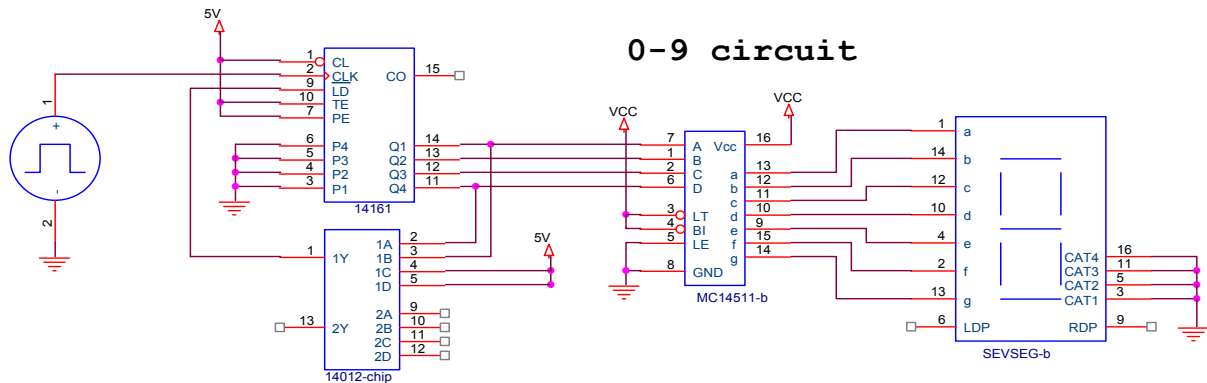
The specific seven-segment display used in lab is an LN513RK. The schematic below is similar to the one you will use in lab.



SEVEN SEGMENT DISPLAY WITH DISPLAY DRIVER

To have the driver convert the binary input to signals ready for the display, tie pin 3, LT, and pin 4, BI, to VCC. Connect pin 5, LE, to ground. In this configuration what ever the binary inputs at A-D are will be converted and the display will show the decimal equivalent.

COUNTING 0-9



0-9 COUNTING CIRCUIT

The start of this circuit is the MC14161 binary counter. The function generator is connected to the clock input to start the counting cycle. The MC14012 NAND gate monitors the output of the binary counter. When the count equals 9 the output of the NAND gate sends a signal to the load control, LD, on the counter to load the values on P1-P4, in this case the number zero. As the counter is

incrementing from 0-9 the driver signal is constantly updating the display and turning on and off the appropriate segments.

If need be you could use a 555 timer circuit in place of the function generator.