



Lab-08

Decoder

Chia-Chun Tsai

Objectives



- Understand the definition of **Decoder**.
- Implement a **BCD-to-Decimal Decoder**
- Implement a **BCD-to-7-segment Decoder**

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What is Decoder

- A binary code is converted to be a decimal number.

For example:

0000 → 0

0001 → 1

...

1001 → 9

...

1111 → 15

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2 to 4 Decoder

- Binary codes 00, 01, 10, and 11 are converted to be respective **decimal numbers 0, 1, 2, and 3.**

Input		Output			
B	A	0	1	2	3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

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3 to 8 Decoder

- BCD codes 000, 001, ..., 100, and 111 are converted to be respective decimal numbers 0, 1, 2, ..., 6, and 7.

Input			Output							
C	B	A	0	1	2	3	4	5	6	7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1

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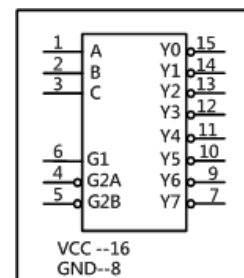
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3 to 8 Decoder with Active Low

- TTL 74138** - 3 to 8 decoder with active low output.

Input			Output							
C	B	A	/0	/1	/2	/3	/4	/5	/6	/7
0	0	0	0	1	1	1	1	1	1	1
0	0	1	1	0	1	1	1	1	1	1
0	1	0	1	1	0	1	1	1	1	1
0	1	1	1	1	1	0	1	1	1	1
1	0	0	1	1	1	1	0	1	1	1
1	0	1	1	1	1	1	1	0	1	1
1	1	0	1	1	1	1	1	1	0	1
1	1	1	1	1	1	1	1	1	1	0

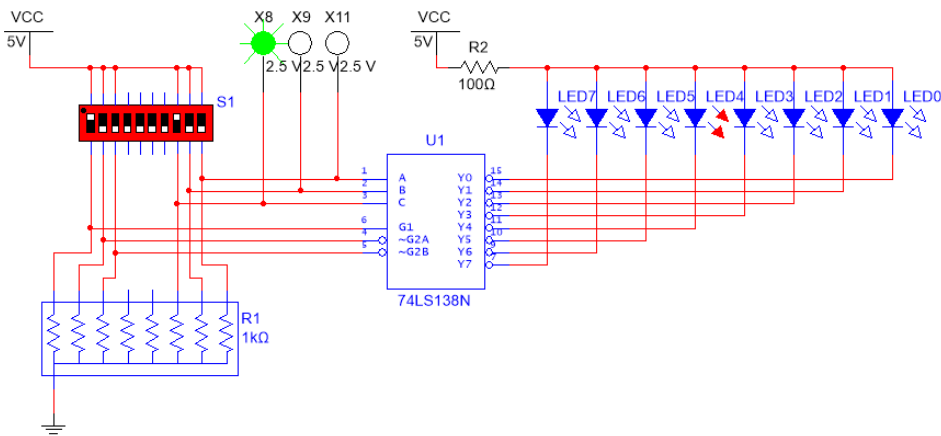


74138

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74138 3 to 8 Decoder with Active Low



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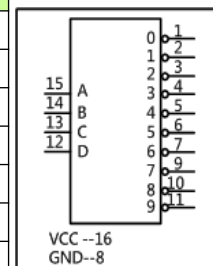
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BCD to Decimal (4 to 10) Decoder



- **TTL 7442:** BCD to decimal (4 to 10) decoder with active low output.

Input				Output									
D	C	B	A	/Y0	/Y1	/Y2	/Y3	/Y4	/Y5	/Y6	/Y7	/Y8	/Y9
0	0	0	0	0	1	1	1	1	1	1	1	1	1
0	0	0	1	1	0	1	1	1	1	1	1	1	1
0	0	1	0	1	1	0	1	1	1	1	1	1	1
0	0	1	1	1	1	1	0	1	1	1	1	1	1
0	1	0	0	1	1	1	1	0	1	1	1	1	1
0	1	0	1	1	1	1	1	1	0	1	1	1	1
0	1	1	0	1	1	1	1	1	1	0	1	1	1
0	1	1	1	1	1	1	1	1	1	1	0	1	1
1	0	0	0	1	1	1	1	1	1	1	1	0	1
1	0	0	1	1	1	1	1	1	1	1	1	1	0



7442

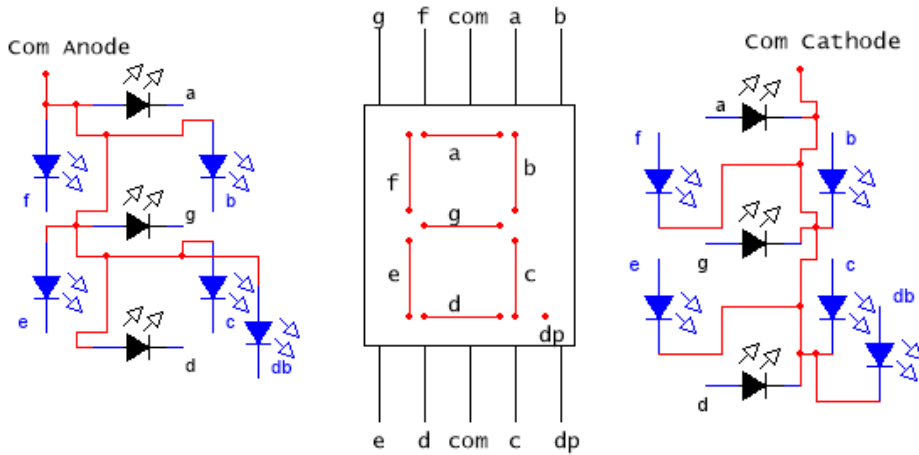
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7-segment Display



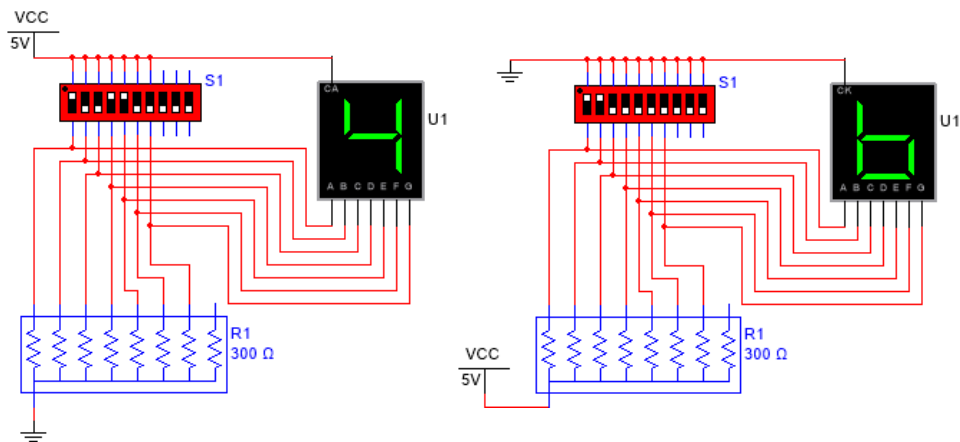
- **Common Anode (CA) 7-segment display LT502**
- **Common Cathode (CK) 7-segment display LT503**



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CA / CK 7-segment Display



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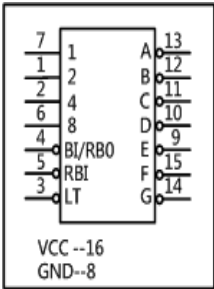
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BCD to 7-segment Decoder

- **TTL 7447: BCD to CA 7-segment decoder with active low output.**

Input				Output							
D	C	B	A	/a	/b	/c	/d	/e	/f	/g	
0	0	0	0	0	0	0	0	0	0	1	0
0	0	0	1	1	0	0	1	1	1	1	1
0	0	1	0	0	0	1	0	0	1	0	2
0	0	1	1	0	0	0	0	1	1	0	3
0	1	0	0	1	0	0	1	1	0	0	4
0	1	0	1	0	1	0	0	1	0	0	5
0	1	1	0	1	1	0	0	0	0	0	6
0	1	1	1	0	0	0	1	1	1	1	7
1	0	0	0	0	0	0	0	0	0	0	8
1	0	0	1	0	0	0	0	1	0	0	9



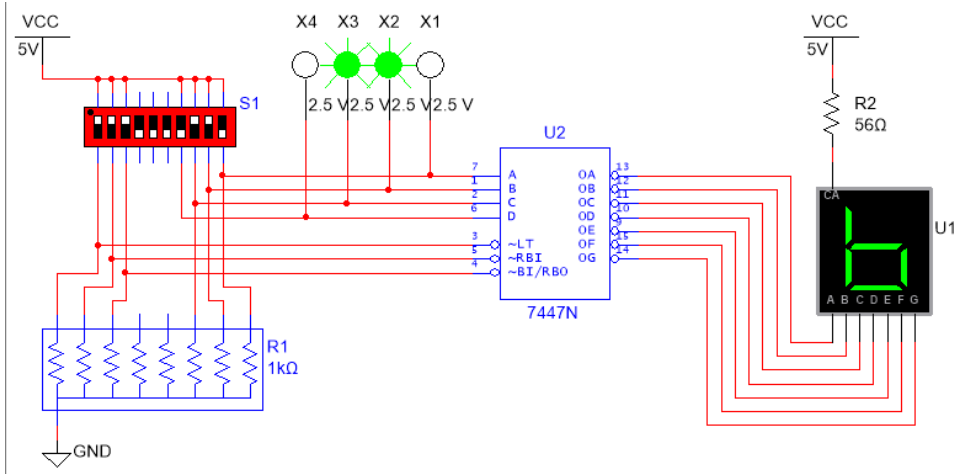
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BCD to 7-segment Decoder



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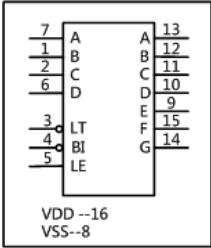
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BCD to 7-segment Decoder

- CMOS 4511: BCD to CK 7-segment decoder with active low output.**

Input				Output							
D	C	B	A	a	b	c	d	e	f	g	
0	0	0	0	1	1	1	1	1	1	0	0
0	0	0	1	0	1	1	0	0	0	0	1
0	0	1	0	1	1	0	1	1	0	1	2
0	0	1	1	1	1	1	1	0	0	1	3
0	1	0	0	0	1	1	0	0	1	1	4
0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	0	0	1	1	1	1	1	6
0	1	1	1	1	1	1	0	0	0	0	7
1	0	0	0	1	1	1	1	1	1	1	8
1	0	0	1	1	1	1	1	0	1	1	9



4511

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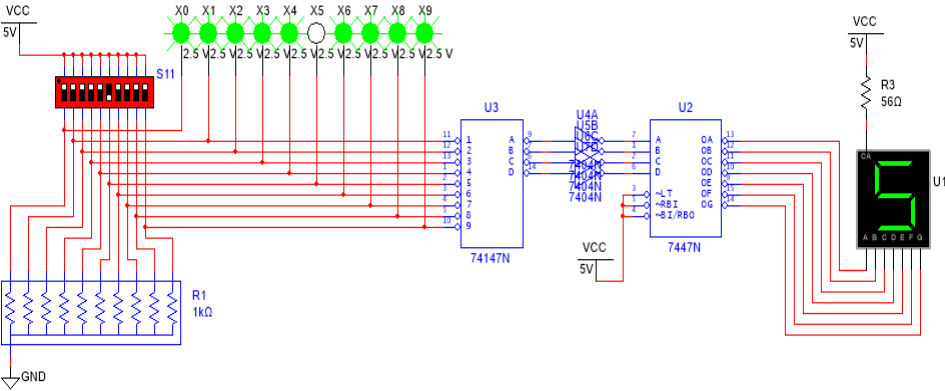
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Decimal to BCD to 7-Segment

Decimal to BCD Priority Encoder

BCD to 7-Segment Decoder



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Decimal to BCD to 7-Segment



Decimal to BCD Priority Encoder

BCD to 7-Segment Decoder

Input										Output			
/0	/1	/2	/3	/4	/5	/6	/7	/8	/9	/D	/C	/B	/A
0	1	1	1	1	1	1	1	1	1	1	1	1	1
X	0	1	1	1	1	1	1	1	1	1	1	1	0
X	X	0	1	1	1	1	1	1	1	1	1	0	1
X	X	X	0	1	1	1	1	1	1	1	1	0	0
X	X	X	X	0	1	1	1	1	1	1	0	1	1
X	X	X	X	X	0	1	1	1	1	1	0	1	0
X	X	X	X	X	X	0	1	1	1	1	0	0	1
X	X	X	X	X	X	X	0	1	1	1	0	0	0
X	X	X	X	X	X	X	X	0	1	0	1	1	1
X	X	X	X	X	X	X	X	X	0	0	1	1	0

Input				Output						
D	C	B	A	/a	/b	/c	/d	/e	/f	/g
0	0	0	0	0	0	0	0	0	1	0
0	0	0	1	1	0	0	1	1	1	1
0	0	1	0	0	0	1	0	0	1	0
0	0	1	1	0	0	0	0	1	1	0
0	1	0	0	1	0	0	1	1	0	0
0	1	0	1	0	1	0	0	1	0	0
0	1	1	0	1	1	0	0	0	0	0
0	1	1	1	0	0	0	1	1	1	1
1	0	0	0	0	0	0	0	0	0	0
1	0	0	1	0	0	0	0	1	0	0

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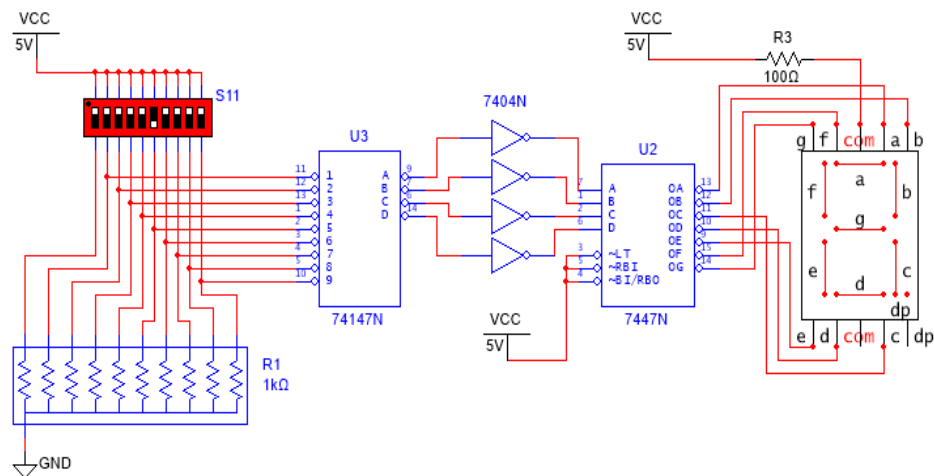


Decimal to BCD to 7-Segment



Decimal to BCD Priority Encoder

BCD to 7-Segment Decoder



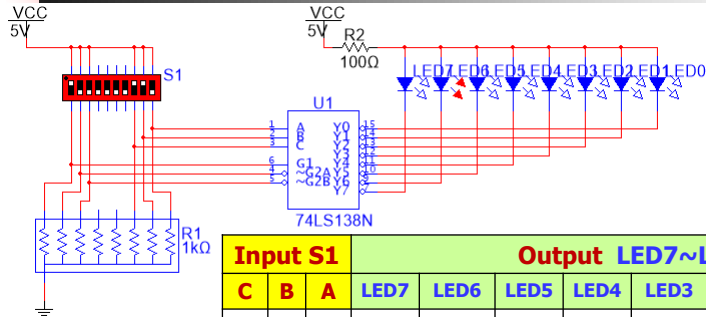
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Experiment-1

3 to 8 Decoder with Active Low



Input S1			Output LED7~LED0							
C	B	A	LED7	LED6	LED5	LED4	LED3	LED2	LED1	LED0
0	0	0								
0	0	1								
0	1	0								
0	1	1								
1	0	0								
1	0	1								
1	1	0								
1	1	1								

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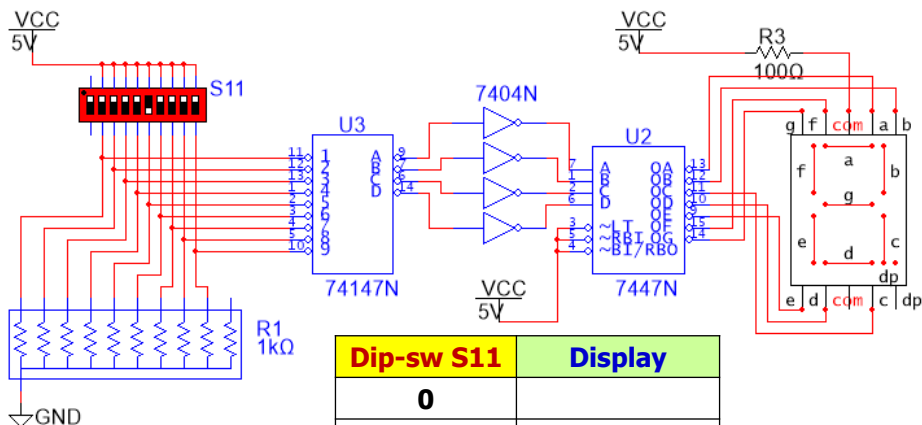


Experiment-2

Decimal to BCD to 7-Segment

Decimal to BCD Priority Encoder

BCD to 7-Segment Decoder



Dip-sw S11	Display
0	
0, 1	

1, 2, 6, 9	

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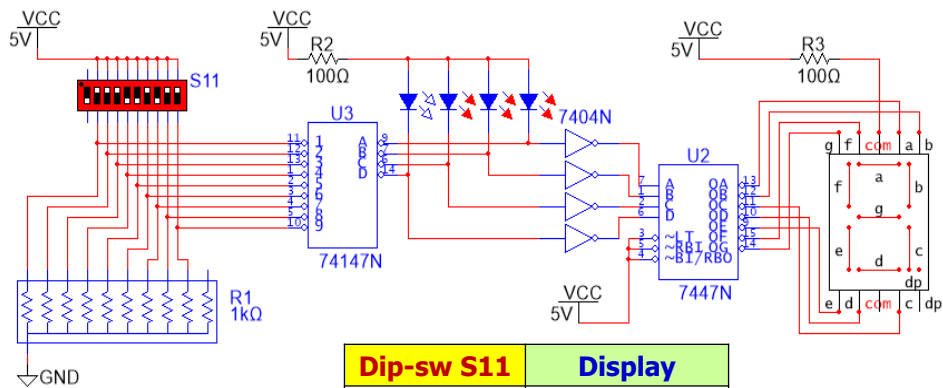
Experiment-2a

Decimal to BCD to 7-Segment



Decimal to BCD Priority Encoder

BCD to 7-Segment Decoder



Dip-sw S11	Display
0	
0, 1	

1, 2, 6, 9	

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