

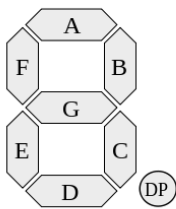
**CPSC 359 – Spring 2019**  
**Assignment 1**  
**BCD to 7-segment Decoder**  
**Due: May 17<sup>th</sup> @ 11:59PM**  
**Weight: 10% of your final mark**

**Objective:** In this assignment, you will design a circuit for a counter that counts from 0 to 9 and you will use a BCD (Binary Coded Decimal) to 7-segment decoder to display the numbers on a 7-Segment display.

**Background:**

BCD (Binary Coded Decimal) is a way of encoding decimal numbers with 4 binary bits as follows:

Decimal	0	1	2	3	4	5	6	7	8	9
BCD	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001



A **7-segment display** is a simple display for representing decimal numerals. It has 7 segments that can be lit in different combinations to represent decimal numbers. . A to D are LEDs that are lit to show the decimal number.

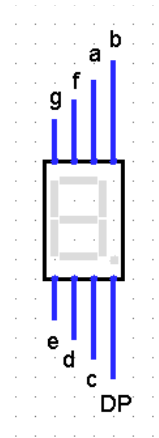
[https://en.wikipedia.org/wiki/Seven-segment\\_display](https://en.wikipedia.org/wiki/Seven-segment_display)

**BCD to 7-segment decoder** is a decoder that converts 4-bit BCD signal into 7-bit control signal to be used as inputs for the **7-segment display** that represents the decimal number. Use the following truth table:

Digit	a	b	c	d	e	f	g
0	on	on	on	on	on	on	off
1	off	on	on	off	off	off	off
2	on	on	off	on	on	off	on
3	on	on	on	on	off	off	on
4	off	on	on	off	off	on	on
5	on	off	on	on	off	on	on
6	on	off	on	on	on	on	on
7	on	on	on	off	off	off	off
8	on	on	on	on	on	on	on
9	on	on	on	on	off	on	on

### Components:

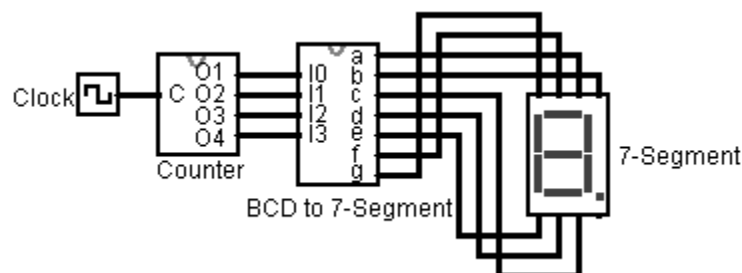
- **7-Segment Display:** You can use the built-in component available in Logisim:
- **BCD to 7-Segment Decoder:** Build a BCD to 7-Segment Decoder as discussed above.
- **BCD counter:** Counts from 0 -> 9 adding one at a rising edge of a clock, the output is in the form of 4-bit binary number as shown. Reset to 0000 (**0**) when you reach 1001 (**9**):



Time	O1	O2	O3	O4	Decimal Representation of the Output
0	0	0	0	0	<b>0</b>
1	0	0	0	1	<b>1</b>
2	0	0	1	0	<b>2</b>
3	0	0	1	1	<b>3</b>
4	0	1	0	0	<b>4</b>
5	0	1	0	1	<b>5</b>
6	0	1	1	0	<b>6</b>
7	0	1	1	1	<b>7</b>
8	1	0	0	0	<b>8</b>
9	1	0	0	1	<b>9</b>
10	0	0	0	0	<b>0</b>
11	0	0	0	1	<b>1 ... and so on</b>

### Notes:

- ✓ You can build the **counter** using sequential circuit (Finite State Machine)
- ✓ All steps for creating **BCD to 7-Segment** and the **BCD counter** must be reported in a pdf report. (K-Map for each output/Simplification of each function).
- ✓ Using the available components in Logisim is not permitted except for wiring, gates, clock and **7-segment display**.



**Deliverables:**

1. Design and implement the corresponding circuit in Logisim.
2. Use building blocks to create the corresponding components.
3. A description of all steps of building the **BCD to 7-segment** and the **BCD counter** must be included in a PDF report.

**Marking Guide:**

BCD to 7-segment	7
4-bit counter	4
Using Blocks	2
Labeling	1
Building Circuit	1
<b>Total</b>	<b>15</b>

**Teams:** You are advised to work with another student in class in order to complete the assignment, but you are not required to do so. Peer evaluation in teams may be conducted.

**Submission:** Submit your pdf report and the .circ file to the appropriate dropbox on D2L. Each team need only make one submission.

**Late Submission Policy:** Late submissions will be penalized as follows:

-12.5% for each late day or portion of a day for the first two days

-25% for each additional day or portion of a day after the first two days

Hence, no submissions will be accepted after 5 days (including weekend days) of the announced deadline

**Academic Misconduct:** Any similarities between assignments will be further investigated for academic misconduct. While you are encouraged to discuss the assignment with your colleagues, your final submission must be your own original work.