# CS 210 Homework 7

Alex Vondrak

DUE: Wednesday, May 23, 2012

In Logisim's `Input/Output` library, there is a device called a *7-Segment Display*, which you've probably seen on calculators, microwaves, etc. It consists of 7 LCD "segments" (straight lines) that can be turned on or off based on eight different inputs (the eighth controls a decimal point, but we won't pay that any mind). When done in a particular way, certain segments light up in concert to form the shape of a decimal digit (e.g., if only the North East and South East segments are on, we see a "1").
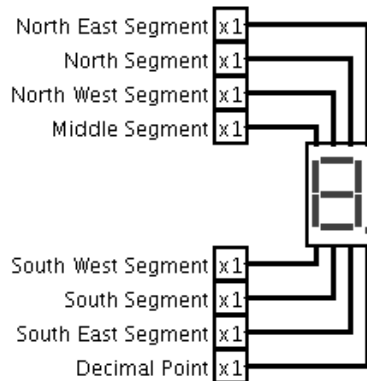
Usually, the decimal digit we want to display is available in BCD format (see page 9 of the notes). Your job for this homework will be to design a circuit to take a BCD digit (i.e., the inputs to your circuit will be the bits of a BCD digit) and convert it into signals that will activate the proper segments of the 7-segment display.

1. Give **seven** different Karnaugh maps—one for each segment of the 7-segment display (ignoring the decimal point). Label your Karnaugh maps by the corresponding name given in the picture above (North East Segment, North Segment, North West Segment, Middle Segment, South West Segment, South Segment, and South East Segment).

2. For **each** of your Karnaugh maps, give the Boolean expression represented by the map in canonical sum of minterms form, and again label them by the proper names. Write your answers using the $\sum(i_1, i_2, i_3, \ldots)$ notation.

3. In Logisim, implement this circuit to control the 7-segment display using a **single** decoder and seven 10-input `OR` gates. Make your diagram as legible as possible—use the same sort of layout as the circuit on page 40 of the notes.