

**Indian Institute of Technology, Delhi**  
**EEL 201: Digital Electronic Circuits**  
**Tutorial 2, 10th August, 2009**

1. Consider the design of a light for the staircase of a house. The light should be controlled from both the bottom and the top of the staircase. The rule to be followed is that switching either switch should change the state of the light, i.e, if the light was on it goes off, if it was off it goes on, when either switch is switched. Develop a truth table for this function.
2. Rewrite  $A + B + C + D$  using only NAND gates.
3. Show that  $A(\overline{B + A \cdot C})$  can be implemented using only one 3-input AND gate.
4. The figure shows the components of a typical seven-segment display. All the decimal digits from 0 to 9 need to be displayed using this. Construct the minimized logic functions for all the seven segments,  $f_a(A_3A_2A_1A_0)$  through  $f_g(A_3A_2A_1A_0)$ , when the input  $A_3A_2A_1A_0$  ranges from 0000 to 1001. Make optimal use of the don't care states.
5. How will the display look like when  $A_3A_2A_1A_0$  is 1010 through 1111?
6. Use only NAND gates to construct the function  $f_a$ .
7. Use only NOR gates to construct the function  $f_g$ .

