Indian Institute of Technology, Delhi
EEL 201: Digital Electronic Circuits
Tutorial 3, 17th August, 2009

1. Simplify the following Boolean functions to (1) a sum of products form (2) a product of sums form:

$$f_1(A, B, C, D) = AB\overline{C} + A\overline{B}D + BCD$$

$$f_2(A, B, C, D) = \Pi(1, 3, 5, 7, 13, 15)$$

2. Minimize the following function using a Karnaugh map of five variables: $f = \sum 0, 2, 4, 6, 8, 10, 12, 14, 17, 19, 21, 23, 24, 25, 26, 27, 29, 31$ Minimize the same function using the Quine-McCluskey tabulation method.

3. Parity is a common error detection mechanism that is often used in data reception or retrieval systems. Consider a parity encoder that is used for data transmission or storage. If a word contains an even number of 1's, the parity bit is 0. If the word has an odd number of 1's, the parity bit is 1. Derive the minimized function for a parity bit generator, where every word contains 6 bits. Use a 6 variable Karnaugh map for the minimization. Can you come up with any other, simpler, logic circuit to generate the parity bit?

4. Consider the addition of two 3-bit unsigned binary numbers, $A_2A_1A_0 + B_2B_1B_0 = S_2S_1S_0$. Develop 6-variable Karnaugh maps for the outputs S_2, S_1, S_0, when the inputs are A_2, A_1, A_0 and B_2, B_1, B_0. Minimize the functions. Can you come up with any other, simpler, logic circuit to generate S_2, S_1 and S_0? Why did minimization fail?

5. Given a two input MUX, write down its truth table. Use it to implement an AND gate.

6. Use a MUX with two inputs to implement the function $A \oplus B \oplus C$. Use a two input MUX to implement $AB + BC + CA$.