Tutorial 3
Logic Circuit Design

CO 2206 Computer Organization

Task 1: Karnaugh Map Exercise

- Simplify the following Boolean functions using Karnaugh map:
  - $F(x,y,z) = \sum m(0,1,5,7)$
  - $F(x,y,z) = \sum m(0,1,2,4,6)$
  - $F(w,x,y,z) = \Sigma m(1,4,6,7,8,9,10,11,15)$
  - $F(A,B,C,D) = \sum m(0,2,5,6,8,10,13,14,15)$
- Find the simplest sum of products form for the function F using the don't care condition G, where
  - $F(a,b,c,d) = \sum m(0,2,8,10,14)$ and
  - $G(a,b,c,d) = \sum m(5,7,12,13)$
- Simplify $F(A,B,C,D) = \prod M(1,3,4,6,9,11)$ together with the don't care conditions $d(A,B,C,D) = \sum m(0,2,5,10,12,14)$ in (i) *sum of products* and (ii) *products of sums*
- Simplify the even parity function using XOR

Task 2: Quine-McCluskey

- Minimize the following functions using the *Quine-McCluskey* minimization:
  - F(x,y,z) = ∑m(0,1,2,4,6)
  - f1(x1, x2, x3, x4) = Σm(0, 6, 7, 9, 13, 14, 15)
  - f2(x1, x2, x3, x4, x5) = Σm(0, 2, 6, 10, 13, 16, 18, 20, 21, 23, 24, 26, 30, 31)

Task 3: Implementation

- Ignoring gate-input cost:
  - Implement all functions in Task 1 using any combination of logic gates
  - Implement all functions in Task 2 using *NAND* only
  - Draw the *NOR* implementation of the function $F = \Sigma m(0,1,2,8,10,11,14,15)$. Hint: Use F'=SOP.