

CS-472: Design Technologies for Integrated Systems

Exercise Problem Set 9

Date: 14/11/2024

Topic: Algebraic methods for multi-level logic synthesis (cf. slide set 11)

Problem 1

Consider the following relations among Boolean variables $a, b, c, d, e, x, y, z, u$:

$$x = a\bar{d} + \bar{a}\bar{b} + \bar{a}\bar{d} + bc + b\bar{d} + ac$$

$$y = a + b$$

$$z = \bar{a}\bar{c} + \bar{a}\bar{d} + \bar{b}\bar{c} + \bar{b}\bar{d} + e$$

$$u = \bar{a}c + \bar{a}d + \bar{b}d + e$$

- (a) Draw the logic network, where inputs are $\{a, b, c, d, e\}$, outputs are $\{x, y, z, u\}$, and each node of the network can compute arbitrary function.
- (b) Perform the algebraic division of f_x/f_y (f_x denotes the Boolean function of x in terms of a, b, c, d and e).
- (c) Substitute y in f_x and redraw the network.

Problem 2

For the following functions:

$$F = abc + abd + c\bar{d}$$

$$G = \bar{b}d + \bar{a}\bar{b} + \bar{b}c$$

- (a) Compute all kernels and co-kernels of F and G .
- (b) Extract a multiple-cube sub-expression common to F and G .