

Design Technologies for Integrated Systems – EPFL

Homework 4

Assigned: 18/10/2018

Due: 25/10/2018

$$F = a'bcd' + bc + a'bc'd' + ab' + abd'$$

Problem 1

Given the Boolean function F :

- (a) Compute the truth table both in binary and hexadecimal notation.
- (b) Draw the min-terms on the cube.
- (c) List all the primes (also on the cube).
- (d) List all the essential primes.
- (e) Find a minimum cover using McCluskey's method (prime implicant table, branch and bound).
- (f) Find a minimum cover using Petrick's method (primes in pos, transform in sop).
- (g) Show the obtained cover on the cube.

Problem 2

Given the Boolean function F , suppose the variable b is in the *don't care* (DC) set (b does not affect the functionality of F due to internal flexibilities in the logic network embedding F).

- (a) What value for b (0 or 1) is the most convenient to reduce the F cover complexity?
In other words, which value for b allows us to find the smallest implicant cover?
Show why this is the case.
- (b) Find a minimum cover (visually from the cube graphical representation).

Problem 3

Given the Boolean function F and the orthonormal basis $\phi_1 = a \oplus b$, $\phi_2 = a \oplus b'$ do:

- (a) show that the basis is orthonormal
- (b) find the upper and lower bounds of the cofactors with respect to the basis
- (c) can you find another set of cofactors with respect to the basis other than the upper and lower bounds? Justify your answer.

Problem 4

Given the Boolean function $F = c'd' + ab'c + a'b'cd' + a'bcd + bcd'$.

- (a) Compute the Boolean difference $\partial F / \partial a$.
- (b) Compute the smoothing $S_a(F)$.
- (c) Compute the consensus $C_a(F)$.

