COE 405, Term 041

COE 561 Digital System Design and Synthesis

HW# 2

Due date: Sunday, Oct. 24

Q.1. Consider the function f=ab+bc+ac. Compute $\partial f/\partial b$. $C_b(f)$ and $S_b(f)$. Represent the function, the Boolean difference, the consensus and the smoothing on the three-dimensional cube.

Q.2. Consider the function f=ab+bc+ac. Compute an expansion on the orthonormal basis $\{\varnothing_1=a, \ \varnothing_2=a'b, \ \varnothing_3=a'b'\}$.

Q.3. Consider the function f=ab+ac+bd. Determine the variable orders that minimize and maximize the size of the corresponding ROBDDs.

Q.4. Consider the functions f=ab+bc amd g=ac. Draw the corresponding ROBDDs and determine the ROBDD corresponding to f⊕g. Assume the variable order (a,b,c).

Q.5. Consider the function whose on-set is F^{ON} = ab'c'+a'bc'+a'bc and whose dc-set is F^{DC}=abc'. Represent the on-set and dc-set in the positional cube notation and compute the off-set using the following:

(i) The SHARP operator.

(ii) The DISJOINT SHARP operator.

(iii) The recursive complementation procedure outlined in section 7.3.4.

Q.6. Consider the function f=ab'c'+a'bc'+a'bc. Determine whether f conatins cube bc by checking the tautology of the cofactor. Use covers in the positional-cube notation and use the procedure outlines in section 7.3.4 for tautology check. Show all steps. Repeat the containment check for cube a'b.

Q.7. Consider the function f=a'd'+a'b+ab'+ac'd.

(i) Form a cover for this function in the positional-cube notation.

(ii) Compute all prime implicants using the method outlined in section 7.3.4.

(iii) Compute all essential prime implicants using the method outlined in section 7.4.4.

(iv) Formulate the problem as a covering problem and find a minimum cover using the branch and bound algorithm EXACT_COVER.

(v) Find a minimum cover by using the tool ESPRESSO-EXACT.

(vi) Find a minimal cover by using the tool ESPRESSO.

Q.8. Consider the function f(a,b,c,d)= Σm(0,1,4,5,7,8,9,12,15).

(i) Apply the following procedures in the given order EXPAND, IRREDUNDANT, REDUCE, EXPAND to obtain a minimized cover. Apply the heuristics used by ESPRESSO. Show each step in detail.

(ii) Verify your results after each step performed by running the ESPRESSO tool.