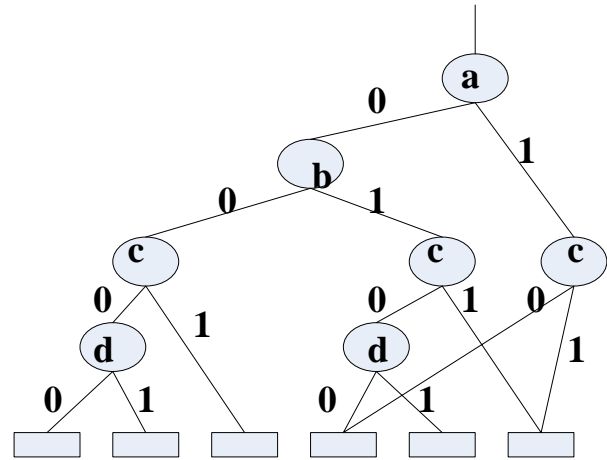


COE 561, Term 071 HW# 2

Due date: Tuesday, Nov. 6th

- Q.1.** Consider the following OBDD with the variable ordering {a, b, c, d}. Reduce it based on **Reduce** function to obtain the ROBDD. Show the details of your work.



- Q.2.** Consider the function $f = a_3 b_3' + (a_3' \oplus b_3) a_2 b_2' + (a_3' \oplus b_3)(a_2' \oplus b_2) a_1 b_1'$
- (i) Implement the function f using **2x1 Multiplexers**. Minimize the number of multiplexers used.
 - (ii) Implement the function f using **4x1 Multiplexers**. Minimize the number of multiplexers used.
 - (iii) Draw the **ROBDD** for the function f using the variable order {a₁, b₁, a₂, b₂, a₃, b₃}. Is this the best ordering used? If not suggest a better ordering and show its ROBDD.
- Q.3.** Consider the two functions $f = a \oplus b \oplus c$ and $g = ac + a'b' + bc'$.
- (i) Compute the following function: $f|_{a=g}$ (substitute a with g)
 - (ii) Draw the **ITE DAG** for the above function. Show the details of the ITE algorithm step by step.

- Q.4.** Consider the following given matrix representing a covering problem:
Find a minimum cover using **EXACT_COVER** procedure. Show the details of the algorithm.

$$A = \begin{bmatrix} 1001100 \\ 1010010 \\ 1100000 \\ 0011100 \\ 0101000 \\ 1001101 \\ 1000011 \\ 1101110 \\ 1011100 \\ 0000001 \end{bmatrix}$$

- Q.5.** Consider the function $f(a,b,c,d)=\sum m(0,1, 2, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15)$.
- (i) Compute the off-set using the recursive complementation procedure outlined in section 7.3.4
 - (ii) Compute all prime implicants of f using the method outlined in section 7.3.4.
 - (iii) Apply the EXPAND procedure on the given cover using Espresso heuristics and show the obtained expanded cover. Compare your solution with the result obtained by ESPRESSO tool.
 - (iv) Apply the IRREDUNDANT procedure on the expanded cover using Espresso heuristics and show the obtained irredundant cover. Compare your solution with the result obtained by ESPRESSO tool.
 - (v) Determine if any of the obtained prime implicants is an essential prime implicant or not using the method outlined in section 7.4.4. If it is essential, remove it from the cover and make the on-sets covered by it don't cares.
 - (vi) Apply the REDUCE procedure on the irredundant cover using Espresso heuristics and show the obtained reduced cover. Compare your solution with the result obtained by ESPRESSO tool.
 - (vii) Apply the EXPAND procedure again on the obtained reduced cover using Espresso heuristics and show the obtained expanded cover. Compare your solution with the result obtained by ESPRESSO tool.
 - (viii) Model the given function in Verilog or VHDL, optimize it using Design Compiler and compare the obtained solution to your solution and the solution obtained by espresso tool.