Nov. 13, 2008

COMPUTER ENGINEERING DEPARTMENT

COE 561

Digital System Design and Synthesis

Major Exam I

(Open Book Exam)

First Semester (081)

Time: 1:00-3:30 PM

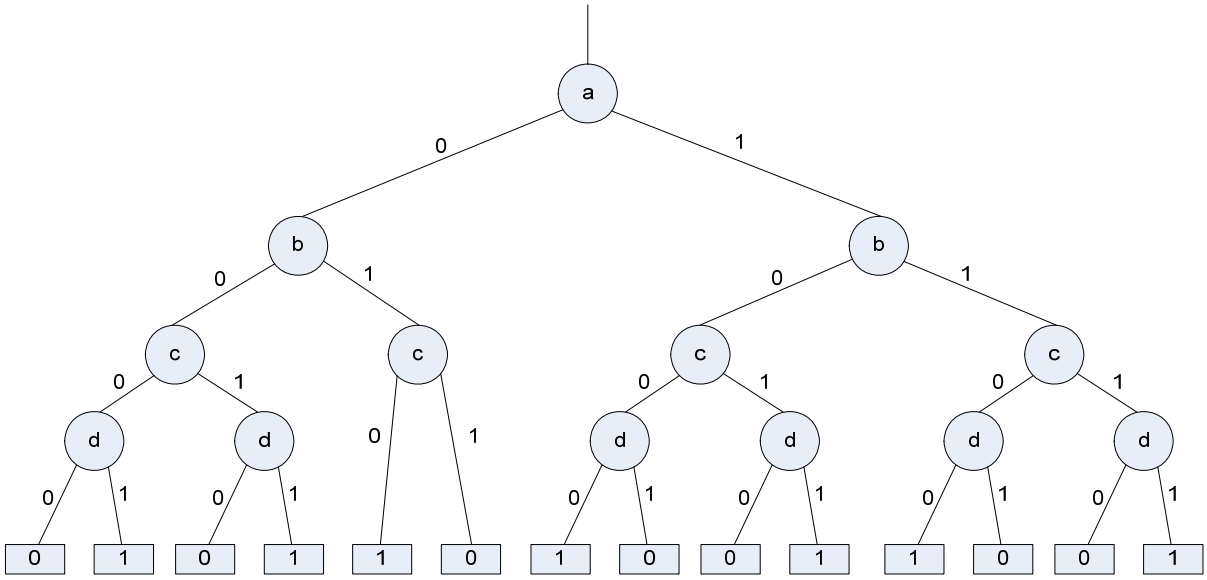
Student Name : _____

Student ID. : _____

Question	Max Points	Score
Q1	10	
Q2	15	
Q3	25	
Q4	30	
Q5	20	
Total	100	

[10 Points]

(Q1) Consider the OBDD given below with the variable ordering {a, b, c, d}. Apply the **Reduce** function to obtain the **ROBDD**. Show the details of applying the algorithm step by step.



[15 Points]

(Q2) Consider the function $F(A,B,C) = \overline{B} + BC + \overline{A}C + B\overline{C}$.

(i) Represent the function using **positional cube notation**.

(ii) Using positional cube notation, compute the **sharp** operation $F \# C$.

(iii) Using recursive paradigm and positional cube notation, determine if the function F is **tautology** or not. You need to choose the right variable for expansion to minimize computations.

[25 Points]

(Q3) Consider the two Boolean functions F_1 and F_2 given below:

$$F_1(A,B,C,D) = ABCD + \overline{A}\overline{B}\overline{C}\overline{D}$$

$$F_2(A,B,C,D) = A \oplus B \oplus C \oplus D$$

(i) Compute the expansion of F_1 and F_2 using the **Orthonormal Basis** {$\varnothing_1$=A'B', $\varnothing_2$=A'B, $\varnothing_3$=AB', $\varnothing_4$=AB}.

(ii) Compute the function $F_1.F_2$.

(iii) Draw the **ITE DAG** for the function $F_1 \oplus F_2$ using the variable order {A, B, C, D}. Use the given functions as is and do not start with the minimized result of $F_1 \oplus F_2$. Show all the details of your solution using ITE procedure.

[30 Points]

(Q4) Consider the function $F(A,B,C,D) = \overline{A}\overline{C}\overline{D} + \overline{B}\overline{C}D + \overline{A}\overline{B}C + AB\overline{C} + A\overline{B}\overline{D}$

(i) Compute the **complement** of the function using the recursive complementation procedure outlined in section 7.3.4.

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

[20 Points]

(Q5) Consider the following given matrix representing a covering problem:

$$\begin{bmatrix} 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 \end{bmatrix}$$

Find a **minimum cover** using **EXACT_COVER** procedure. Show all the details of the algorithm. Assume the following order in branching selection when needed: C_1, C_2, C_3, C_4, C_5, C_6, C_7.