Logic Circuits

Tutorial 3 (Boolean Algebra & Logic Gates, Simplification) **Deadline: 2079/10/9**

1) Simplify the following expressions using Boolean Algebra:
   i) $((AB^{I}+ABC)^{I}+A(B+(AB)^{I}))^{I}$
   ii) $A^{I}C(ABD)^{I}+A^{I}B(CD)^{I}+AB^{I}C$
2) Define minterm and maxterm. Write all the minterms and maxterms for 4-variables.
3) Express the following Boolean functions in Sum of Minterms and Product of Maxterms:
   i) $F(A,B,C)=A^{I}B+C^{I}$
   ii) $F(A,B,C,D)=D(A^{I}+B)+B^{I}D$
4) Simplify:
   i) $Xyz+x^{I}y+xyz^{I}$ Ans: y
   ii) $x+yz+x^{I}(y^{I}+z^{I})$ Ans: 1
   iii) $(x+y)(x^{I}+z)(y+z^{I})$ Ans: $(x+y)(x^{I}+z)$
   iv) $(BC^{I}+A^{I}D)(AB^{I}+CD^{I})$ Ans: 0
   v) $ABC^{I}D^{I}+A^{I}BC^{I}D^{I}+BC^{I}D$ Ans: BC^{I}
5) Simplify the following Boolean functions in to minimum number of literals in SOP and POS form using Boolean algebra:
   i) $ABC+AB^{I}(A^{I}C^{I})^{I}$ Ans: $AB^{I}+AC$, $A(B^{I}+C)$
   ii) $(AB+C)(B+C^{I}D)$ Ans: (AB+BC), B(A+C)
   iii) $x^{I}+x(x+y^{I})(y+z^{I})$ Ans: $x^{I}+y+z^{I}$, $(x^{I}+y+z^{I})$

   Also draw the logic diagram for the above results.

6) Convert $F(A,B,C)=AB+BC+AC^{I}$ into standard SOP form
7) Convert $F(A,B,C)=(A+B)(A+C)(B+C^{I})$ into standard POS form.
   [Hint: Standard SOP=Sum of Minterms &
   Standard POS= Product of Maxterms]
8) Using K-map, simplify the following Boolean functions in SOP and POS form:
   i) $F(A,B,C,D)=\sum(5,7,9,12,13,14,15)$ with don't care $d(A,B,C,D)=\sum(3,6,8)$.
   ii) $F(A,B,C,D)=\sum(0,6,8,13,14)$ with don't care $d(A,B,C,D)=\sum(2,4,10)$.
   iii) $F(A,B,C,D)=\sum(2,3,7,10,11,14)$ with don't care $d(A,B,C,D)=\sum(1,5,15)$.
   iv) $F(A,B,C,D)=\sum(1,4,5,6,12,14,15)$ with don't care $d(A,B,C,D)=\sum(10,11)$.