Homework 2-PartA:

Simplify each of the following expressions by applying one of the theorems. State the theorem used.

(a) X'YZ + (XYZ')' = X'YZ + X'+ Y'+Z= X'+Y'+Z

(b) (AB + C'D)(BE' + C'D) = ABE' + AB C'D + C'D BE' + C'D = ABE' + C'D (AB + BE' + 1) = ABE' + C'D

(c) XYZ +XY'Z = XZ(Y +Y')= XZ

(d) A(C +D'B) + A'B = AC +AD'B + A'B = AC + B(AD'+A')

(e) (AB + C + D')(A'B + D') = A A'B + AB D'+ CA'B + CD'+ D'A'B + D' = CA'B +D'(AB+C+A'B+1)= CA'B +D'

(f) (A + BC')' + (DE + F)(A+BC')= (A + BC')' + DE + F = A'(B'+C)+DE+F

2. Multiply out and simplify to obtain a sum of products(SOP):

(a) (A + B') (CD + B) (D' + BC)(AC'D +E) = (ACD + AB)(D' + BC)(AC'D +E) +(B'CD + B'B)(D' + BC)(AC'D +E)

= (ACD + AB) (D' AC'D + BC AC'D) + (ACD + AB) (D'E + BCE) +(B'CD + B'B)(D' AC'D + BC AC'D) +(B'CD + B'B)(D'E + BCE)

=(ACD + AB) (BC AC'D) + (ACD + AB) (D'E + BCE) +(B'CD)(BC AC'D) +(B'CD)(D'E + BCE)

= ABBC AC'D + (ACD + AB) (D'E + BCE) +B'CDBC AC'D +B'CD BCE

= (AB D'E + AB BCE) + (ACD D'E + ACD BCE)

= AB D'E + ABCE + ACDBE = ABE(D' + C + CD) = ABE(D' + C)= ABED'+ ABEC

(b) (A' + B' + C) (A' +B + D) (C' + D') = (A' + B' + C) (A' +B + D) (C' + D') = (A'+(B'+C)(B+D)) (C' + D')

= (A'+B'B+B'D+CB+CD) (C' + D')= A' C' +B'D C'+ A' D' +CB D'

3. Find F and G and simplify:

a) F =((AB)'(C'+D)+E)' = AB+CD'+E'

b) G=((RST)'+P+(RS)'+T)'+T =(RST)P'(RS)T'+T = RSTP'+T=T

For each of the following circuits, find the output and design a simpler circuit that has the same output. (Hint: Find the circuit output by first finding the output of each gate, going from left to right, and simplifying as you go).

A) (A+A')BBB=B
B) ((A'+A')(B'+A))'=A+BA'=A+B
C) ((A+B)C')'+D + ((A+B)C')'D = A'B'+C+D

5. Factor each of the following expressions to obtain a product of sums:

(a) WV + U'YV = (W + U'Y)V = (W+U')(W+Y)V

(b) TW + UY' +VW =(T+V)W+ UY' =(T+V + UY')(W+ UY') =(T+V + Y')(W+ Y')(T+V + U)(W+ U)

(c) AB'C + BC'D + BEC = B'AC + B(C'D + EC) = (B+AC)(B'+ C'D + EC)

= (B+C) (B+A)(B'+ C'D + C)(B'+ C'D + E)= (B+C) (B+A) (B'+ C' + C) (B'+ D + E) (B'+ D + C) (B'+ C' + E)

(d) ABC + AD'E' + A'BF' = A(BC + D'E') + A'BF'=(A+BF')(A'+BC+D'E')

= (A+F')(A'+C+D'E')(A+B)(A'+B+D'E') = (A+F')(A+B)(A'+C+E')(A'+B+E') (A'+C+D')(A'+B+D')

6. Find F, G, and simplify:

A) (((A'B)'+B)'+B)C = ((A+B'+B)'+B)C=CB

B) ((A+B)' + BC)' + (BC)' = (A+B)(B'+C')+B'+C' = B'+C'