Homework 1

CSE 232

March 2021

1. (30 points) Simplify the following function by using boolean algebra $F(x, y, z) = xy + x'z + yz$.
2. (30 points) Derive that $(x + y)(y' + z)(y + z) = (x + y)(x' + z)$ by using boolean algebra.
3. (a) (30 points) Express the following function in **sum of minterms** and **product of maxterms** by using truth table $F(A, B, C, D) = B'D + A'D + BD$.
   (b) (10 points) Simplify the standard expression $F(A, B, C, D) = B'D + A'D + BD$.

1. $F(x,y,z) = xy + x'z + yz(x+x')$

$= xy + x'z + xyz + x'yz$

$= xy(1+z) + x'z(1+y)$

$= xy + x'z$

2. (x+y)(x'+z)(y+z)=(x+y)(x'+z)

$((x+y)(x'+z)(y+z))' = ((x+y)(x'+z))'$

$x'y' + xz' + y'z' = x'y' + xz'$

$x'y' + xz' + y'z'(x+x') = x'y' + xz'$

$x'y' + xz' + xy'z' + x'y'z' = x'y' + xz'$

$x'y'(1+z') + xz'(1+y) = x'y' + xz'$

$x'y' + xz' = x'y' + xz'$ ✓

3a) $F(A,B,C,D) = B'D + A'D + BD$

A	B	C	D	B'D	A'D	BD	F
0	0	0	0	0	0	0	0
0	0	0	1	1	1	0	1
0	0	1	0	0	0	0	0
0	0	1	1	1	1	0	1
0	1	0	0	0	0	0	0
0	1	0	1	0	1	1	1
0	1	1	0	0	0	0	0
0	1	1	1	0	1	1	1
1	0	0	0	0	0	0	0
1	0	0	1	1	0	0	1
1	0	1	0	0	0	0	0
1	0	1	1	1	0	0	1
1	1	0	0	0	0	0	0
1	1	0	1	0	0	1	1
1	1	1	0	0	0	0	0
1	1	1	1	0	0	1	1

$F = A'B'C'D + A'B'CD + A'BC'D + A'BCD + AB'C'D + AB'CD + ABC'D + ABCD$

$= \Sigma(1,3,5,7,9,11,13,15)$

$F = (A+B+C+D)(A+B+C'+D)(A+B'+C+D)(A+B'+C'+D)(A'+B+C+D)$.

$(A'+B+C'+D)(A'+B'+C+D)(A'+B'+C'+D)$

$= \Pi(0,2,4,6,8,10,12,14)$

(b) (10 points) Simplify the standard expression $F(A, B, C, D) = B'D + A'D + BD$.

$$F(A,B,C,D) = D(A' + B' + B)$$

$$= D(A' + 1) = D$$