

Simplification of problem (a)



$$AB + A(B+C) + B(B+C)$$

$$= AB + AB + AC + B + BC$$

[Distributivity]

$$= AB + AC + B + BC$$

[Idempotency]

$$= AC + AB + B + BC$$

[Commutativity]

$$= AC + B(A + 1 + C)$$

[Distributivity]

$$= AC + B$$

[Idempotency]

Simplification of problem (B)



$$A'B + BC' + BC + AB'C'$$

$$= A'B + BC + BC' + AB'C' \quad [\text{Commutativity}]$$

$$= A'B + BC + C'(B + AB') \quad [\text{Distributivity}]$$

$$= A'B + BC + C'((B+A)(B+B')) \quad [\text{Distributivity}]$$

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

$$= A'B + BC + C'A + BC' \quad [\text{Distributivity}]$$

$$= A'B + BC + BC' + C'A \quad [\text{Commutativity}]$$

$$= BA' + BC + BC' + C'A \quad [\text{Commutativity}]$$

$$= B(A' + C + C') + C'A \quad [\text{Distributivity}]$$

$$= B + C'A \quad [\text{Complement}]$$

$$= B + AC' \quad [\text{Commutativity}]$$

Simplification of problem (c)



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

$$= xy'z' + xy'z + xy'z' \quad [\text{Duality}]$$

$$= xy' (z'+z) + xy'z' \quad [\text{Distributivity}]$$

$$= xy' + xy'z' \quad [\text{Complement}]$$

$$= x(y' + yz') \quad [\text{Distributivity}]$$

$$= x(y' + y) (y' + z') \quad [\text{Distributivity}]$$

$$= x(y' + z') \quad [\text{Complement}]$$

$$= x + y'z' \quad [\text{DUALITY}]$$