

① (a) $x'y'z + xz$ Given
 $z[(x'y) + x]$ Distributive
 $z[(x'x) + (yx)]$ Contradiction
 $z(0 + yx)$ Identity
 \boxed{xyz}

(b) $xyz + x'y'z + xy'z + (xyz')'$ Given
 $xyz + x'y'z + xy'z + (x'y'z)''$ De Morgan's
 $xyz + x'y'z + xy'z + x'y'z$ Involution,
 $z(xy + x'y + xy' + x'y')$ Distributive
 $z[(x+x')(y+y')]$ Distributive
 \boxed{z} Complimentarity

(c) $abc + a'b + abc'$ Given
 $abc + abc' + a'b$ Commutative
 $ab(c+c')$ Distributive
 $ab + a'b$ Complementarity
 $b(a+a')$ Distributive
 \boxed{b} Complementarity

(d) $A(C + D'B) + A'B$ Given
 $\boxed{AC + AD'B + A'B}$ Distributive

$$(e) (d+bc')' + (ge+f) + (d+bc') \text{ Given}$$

Substitution
 $H' + (ge+f) + H$
 $H' + H + (ge+f)$

$\boxed{ge+f}$

Commutative
 Complementarity

$$\textcircled{2} (a) (ab+c)(b+c'd) \text{ Given}$$

$$abb + ac'd + cb + cc'd$$

Distributive

$$\underline{ab + ac'd + cb + cc'd}$$

Idempotency

$\boxed{ab + ac'd + cb + d}$

Complementarity

$$(b) x' + x(x+y')(y+z') \text{ Given}$$

Distributive

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

Idempotency

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

Distributive

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

Complementarity

$$x' + xy + xz' + x + xy'z$$

Commutativity

$$x' + x + xy + xz' + xy'z$$

Commutativity

$\boxed{xy + xz' + xy'z}$

Complementarity

$$\textcircled{3} \text{ (a)} \quad (((AB)'(D+C')) + F) \quad \text{Given}$$

$$((A'+B')(D+C')) + F \quad \text{De Morgan's}$$

$$\boxed{A'D + A'C' + B'D + B'C + F} \quad \text{Distributive}$$

$$\text{(b)} \quad ((RST)' + P + ((RS)' + T))' + T \quad \text{Given}$$

$$((R' + S' + T') + P + ((R' + S') + T))' + T \quad \text{De Morgan's}$$

$$((R' + S' + T') + P + (R' + S' + T))' + T$$

Substitute $H = R' + S' + T$

$$(H + P + H)' + T \quad \text{Substitution}$$

$$(H + H + P)' + T \quad \text{Commutative}$$

$$(H + P)' + T \quad \text{Idempotency}$$

$$H'P' + T \quad \text{De Morgan's}$$

$$(R' + S' + T)'P' + T \quad \text{Substitution}$$

$$RSTP' + T \quad \text{De Morgan's}$$

$$T(RSP' + 1) \quad \text{Distributive}$$

$$\boxed{TRSP'} \quad \text{Identity}$$

$$\textcircled{4} \text{ (a)} \quad ((A+A')B)(BB) \quad \begin{array}{l} \text{Given} \\ (I)(B)(BB) \\ \boxed{B} \end{array}$$

Complementarity
Idempotency

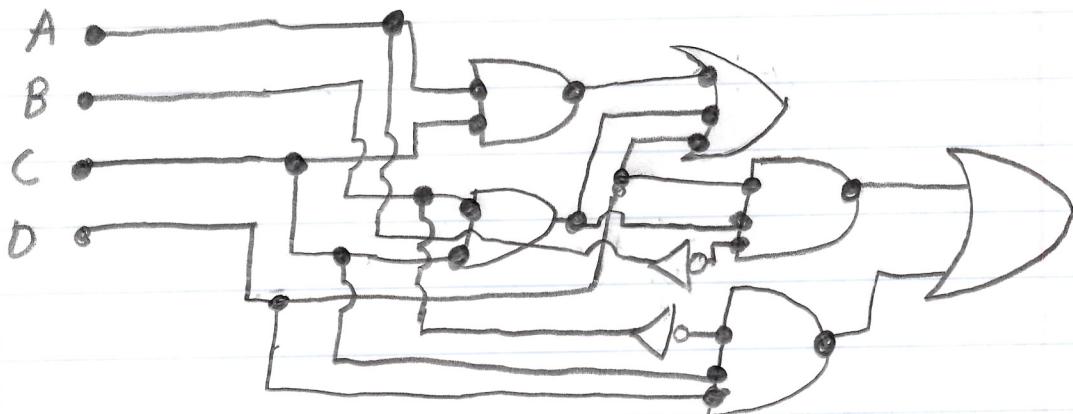
$$B \longrightarrow F_1$$

$$\textcircled{4} \text{ (b)} \quad ((A'+A')(A+B'))' \quad \begin{array}{l} \text{Given} \\ (A' (A+B'))' \\ (A'A + A'B')' \\ (1 + A'B')' \\ (A'B')' \\ \boxed{A + B} \end{array}$$

Idempotency
Distributive
Complementarity
Identity
De Morgan's



$$\begin{aligned}
 & \textcircled{4} \quad (c) \quad ((A+B)C')' + D) + (D(C'(A+B))') \quad \text{Given} \\
 & ((C'C'A + C'B)' + D) + (D(C'C'A + C'B))' \quad \text{Distribution} \\
 & ((C+A)(C+B) + D) + (D((C+A')(C+B'))) \quad \text{De Morgan's} \\
 & ((C+A)(C+B) + D) + (D(CC + CA' + CB' + AB')) \quad \text{Distribution} \\
 & (CC + AC + CB + AB + D) + (DC + DCA' + DCB' + DA'B') \quad \text{Distribution} \\
 & (C + AC + CB + AB + D) + (DC + DCA' + DCB' + DA'B') \quad \text{Idempotency} \\
 & (C(1+A+B) + AB + D) + (DC(1+A'+B') + DA'B') \quad \text{Distribution} + 1 \\
 & (CA + CB + AB + D) + (DCA' + DCB' + DA'B') \quad \text{Distribution} \\
 & \boxed{(CA + CB + D) + (DCA' + DCB')} \quad \text{Consensus}
 \end{aligned}$$



⑤ a)
$$\frac{(ab+c)(b+c'd)}{(a+c)(a+b)(b+c')(b+d)}$$

b)
$$\frac{(x+y^+)(y^++z)}{y'(x+z)}$$

c)
$$\frac{x'z + wx'y + wyz' + w'y'}{x'(z+wy) + (y+w')(y'+wz')}$$

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

d)
$$\frac{(xy+yz' + x'z)(x+z)}{((xy + x'z) + yz')(x+z)}$$
 Rule #2

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

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

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

$$(x+yz')(x'+yz'+z)(x+z)$$

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

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

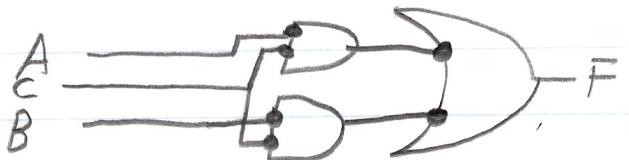
$$\textcircled{6} \text{ a) } F = (((A'B')' + B)' + B)C \quad \begin{matrix} \text{Given} \\ \text{De Morgan's} \\ \text{Associative} \end{matrix}$$

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

$$((A+(B'+B))' + B)C \quad \begin{matrix} \text{Complementarity} \\ \text{Distributive} \end{matrix}$$

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

$$F = AC + BC$$



$$\textcircled{6} \text{ b) } \begin{matrix} ((A+B)' + (BC))' + ((CB)')' \\ ((A'B' + BC)' + (C'B'))' \\ [(A+B)(B'+C')]' + (C'B')' \\ (AB + AC' + BB' + BC') + (C'B')' \end{matrix} \quad \begin{matrix} \text{Given} \\ \text{De Morgan's} \\ \text{De Morgan's} \\ \text{Distributive} \end{matrix}$$

$$(AB + AC' + BC') + (C'B')' \quad \text{Complementarity}$$

$$(AB + AC') + (BC' + C') + B' \quad \text{Associative}$$

$$(AB + AC') + C'(B+1) + B' \quad \text{Distributive}$$

$$(AB + AC') + C'B + B' \quad \text{Identity}$$

$$\boxed{AB + AC' + C'B + B'}$$

