9 (g) $\overline{AB + CD} = \overline{AB} \cdot \overline{CD} = (\overline{A} + \overline{B})(\overline{C} + \overline{D})$

10 (c) $\overline{(A + \overline{B} + C + \overline{D})} + \overline{ABC\overline{D}}$

$= \overline{A}\,\overline{\overline{B}}\,\overline{C}\,\overline{\overline{D}} + \overline{A} + \overline{B} + \overline{C} + \overline{D}$

$= \overline{A}B\overline{C}D + \overline{A} + \overline{B} + \overline{C} + D$

$= \overline{A} + \overline{B} + \overline{C} + D$

11 (b) $\overline{(A + \overline{B}\,\overline{C} + CD)} + \overline{\overline{B}\overline{C}}$

$= \overline{A}\,(\overline{\overline{B}\,\overline{C}})\,(\overline{CD}) + BC$

$= \overline{A}\,B\overline{C}\,(\overline{C} + \overline{D}) + BC$

$= \overline{A}B\overline{C}\overline{C} + \overline{A}B\overline{C}\,\overline{D} + BC$

$= \overline{A}B\overline{C} + \overline{A}B\overline{C}\overline{D} + BC$

$= \overline{A}B\overline{C} + BC$

$= B(\overline{A}\overline{C} + C)$

$= B(\overline{A} + C)$

$= \overline{A}B + BC$

13 (c)

$X = \overline{(\overline{A}\,B)}$

(d)

$X = (A + B) \cdot C$

15 (d) $X = A + B[C + D(B + \bar{C})]$
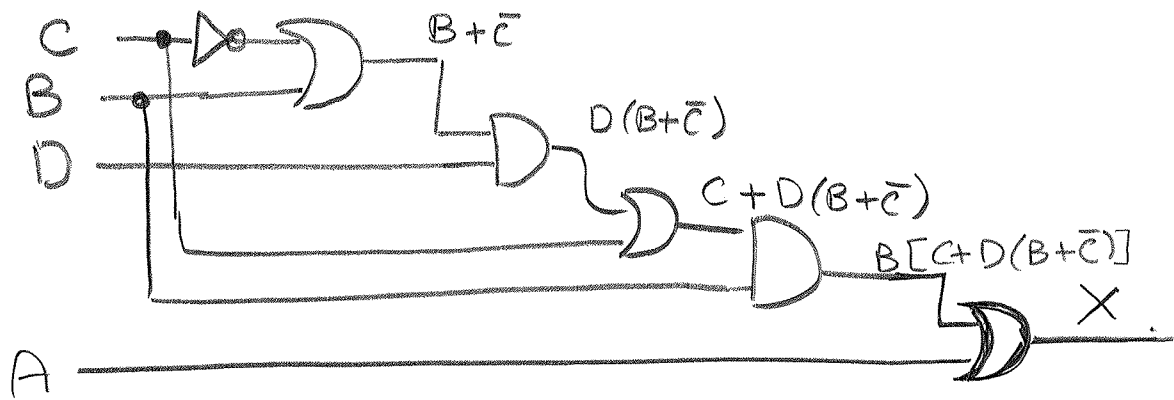
16 (b)
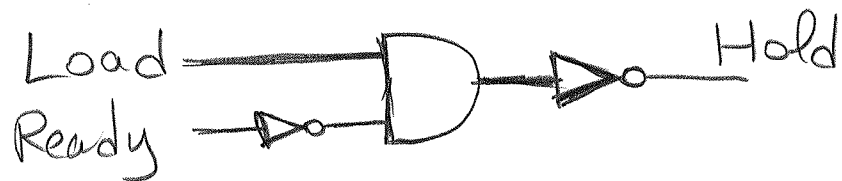
18 (e)

A	B	C	A+B	$\bar{B}+C$	$(A+B)(\bar{B}+C)$
0	0	0	0	1	0
0	0	1	0	1	0
0	1	0	1	0	0
0	1	1	1	1	1
1	0	0	1	1	1
1	0	1	1	1	1
1	1	0	1	0	0
1	1	1	1	1	1

19 (e) $A\bar{B}C + \bar{A}BC + \bar{A}\bar{B}C$

$= A\bar{B}C + \bar{A}C(B + \bar{B})$ [DL]

$= A\bar{B}C + \bar{A}C$ [R6, R4]

$= (A\bar{B} + \bar{A})C$ [DL]

$= (\bar{B} + \bar{A})C$ [R11]

$= \bar{B}C + \bar{A}C$ [DL]

21 (c) $(B+BC)(B+\bar{B}C)(B+D)$

$= B(B+C)(B+D)$ [R10, R11]

$= B(B+CD)$ [R12]

$= BB + BCD$ [DL]

$= B + BCD$ [R7]

$= B$ [R10]

← General Expression

24 (c) $A + B[AC + (B+\bar{C})D]$

$= A + ABC + B(B+\bar{C})D$

$= A + BBD + B\bar{C}D$

$= A + BD + B\bar{C}D$

$= A + BD$ ← non-standard SOP

↓

← non-standard SOP

26 (c) $A + BD$

$= A(B+\bar{B})(D+\bar{D}) + (A+\bar{A})BD$

$= ABD + AB\bar{D} + A\bar{B}D + A\bar{B}\bar{D} + ABD + \bar{A}BD$

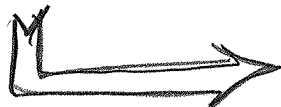$= ABD + AB\bar{D} + A\bar{B}D + A\bar{B}\bar{D} + \bar{A}BD$ ← standard SOP

↓

---

30 (c)

standard SOP

$X = ABD + AB\bar{D} + A\bar{B}D$
$+ A\bar{B}\bar{D} + \bar{A}BD$

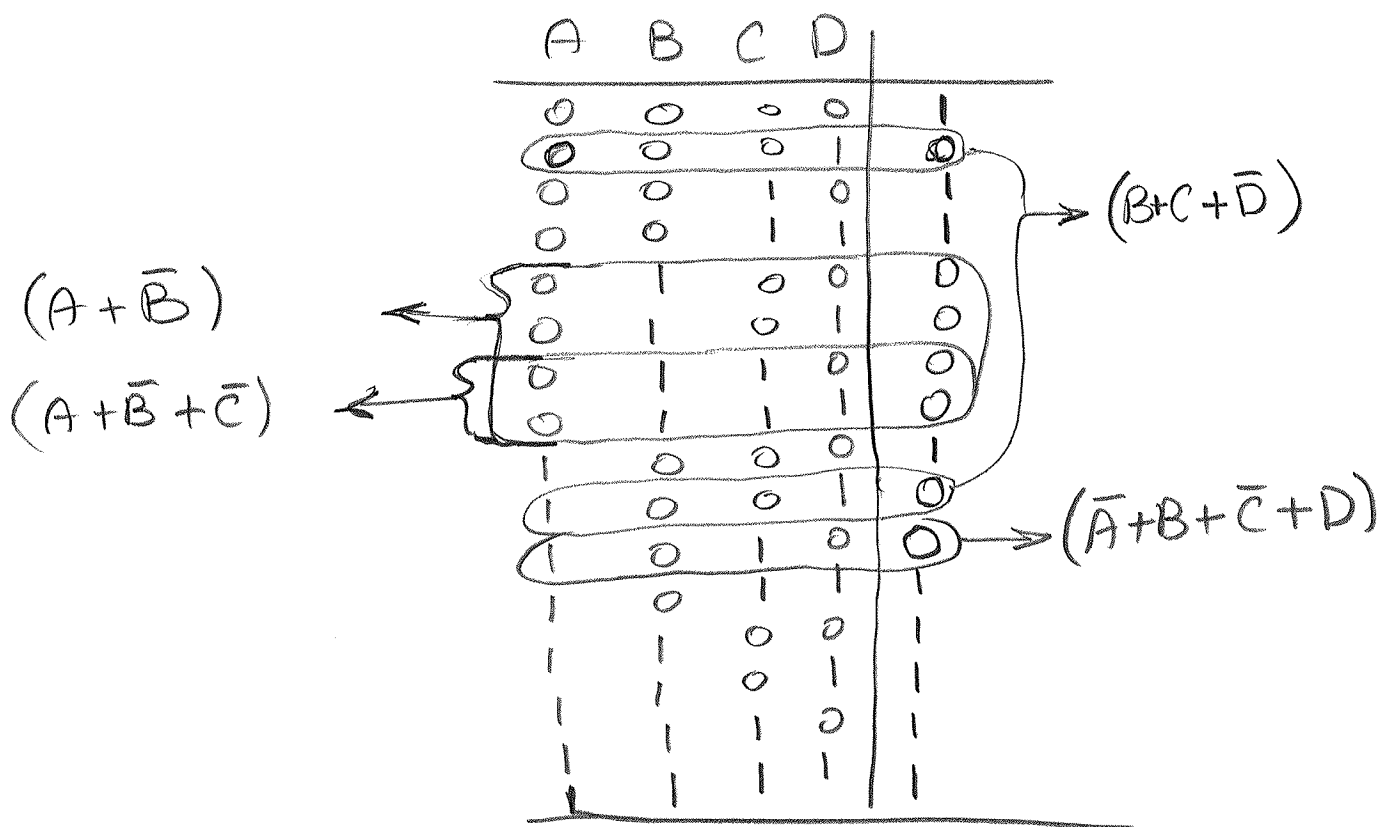| A	B	D	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

standard-POS

$X =$
$(A + B + D)$
$(A + B + \bar{D})$
$(A + \bar{B} + D)$

35 (b)

$$X = (A + \bar{B})(A + \bar{B} + \bar{C})(B + C + \bar{D})(\bar{A} + B + \bar{C} + D)$$

⇓   ⇓   ⇓   ⇓

0 1 x x   0 1 1 x   x 0 0 1   1 0 1 0

A	B	C	D
0	0	0	0
0	0	0	1
0	0	1	0
0	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
0	1	1	1
1	0	0	0
1	0	0	1
1	0	1	0
1	0	1	1
1	1	0	0
1	1	0	1
1	1	1	0
1	1	1	1

$(A + \bar{B})$

$(A + \bar{B} + \bar{C})$

$(B + C + \bar{D})$

$(\bar{A} + B + \bar{C} + D)$

---

36 (b) Standard POS

$$X = (A + B + C) \cdot$$
$$(A + B + \bar{C})$$
$$(A + \bar{B} + C)$$
$$(A + \bar{B} + \bar{C})$$
$$(\bar{A} + B + C)$$

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Standard SOP

$$X = A\bar{B}C + AB\bar{C} + ABC$$