EE2020 Tutorial 4 - Solutions

1.

Truth Table

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

$$Z_{SOP} = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + \bar{A}BC\bar{D} + A\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}D + AB\bar{C}\bar{D}$$

$$Z_{POS} = (A + \bar{B} + \bar{C} + \bar{D}).(\bar{A} + B + \bar{C} + D).(\bar{A} + B + \bar{C} + \bar{D}).(\bar{A} + \bar{B} + C + \bar{D}).(\bar{A} + \bar{B} + \bar{C} + D).(\bar{A} + \bar{B} + \bar{C} + \bar{D})$$
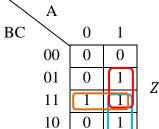
AB

CD	00	01	11	10
00	1	1	1	1
01	1	1	0	1
11	1	0	0	0
10	1	1	0	0

$$Z_{MSOP} = \bar{A}\bar{B} + \bar{C}\bar{D} + \bar{A}\bar{C} + \bar{A}\bar{D} + \bar{B}\bar{C}$$

2.

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

$Z_{SOP} = \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$

$Z_{POS} = (A + B + C).(A + B + \bar{C}).(A + \bar{B} + C).(\bar{A} + B + C)$

$Z_{MSOP} = AC + BC + AB$

3.   (a) $Z = \overline{A}\,\overline{B}CD + \overline{A}BCD + AB\overline{C}D + A\overline{B}\,\overline{C}D + A\overline{B}\,\overline{C}\,\overline{D}$ with 'X' for $ABCD = 1010$
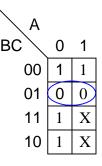

MSOP

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

MPOS

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

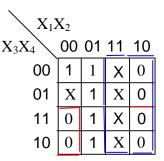(b) $Z = (\overline{A} + B + \overline{C})(A + B + \overline{C})$ with don't cares for $ABC = 111$ and 110

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MSOP
$$Z = B + \overline{C}$$

MPOS
$$Z = (B + \overline{C})$$

(c) $f(x_1, \cdots, x_4) = \sum m(0,4,5,6,7) + D(1,12,13,14,15)$, where D is the set of don't cares and m is the set for which $f = 1$ (this alternate shorthand notation is also used to express min terms).
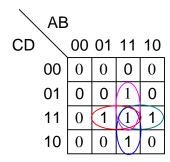
X_3X_4 \ X_1X_2	00	01	11	10
00	1	1	X	0
01	X	1	X	0
11	0	1	X	0
10	0	1	X	0

MSOP
$$Z = (x_2 + \overline{x}_1\overline{x}_3)$$

X_3X_4 \ X_1X_2	00	01	11	10
00	1	1	X	0
01	X	1	X	0
11	0	1	X	0
10	0	1	X	0

MPOS
$$Z = (x_2 + \overline{x}_3) \cdot (\overline{x}_1)$$

4.

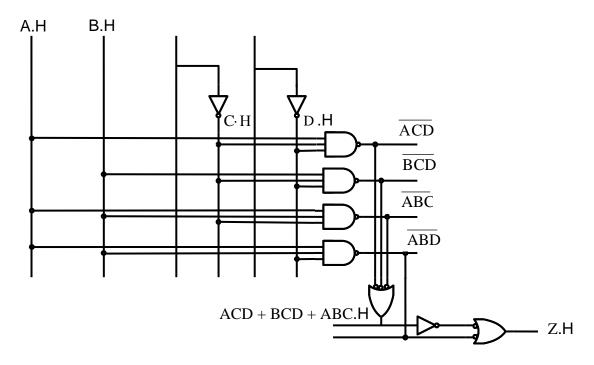| CD \ AB	00	01	11	10
00	0	0	0	0
01	0	0	1	0
11	0	1	1	1
10	0	0	1	0

MSOP
$$Z = ACD + BCD + ABC + ABD$$

$$Z = ACD + BCD + ABC + ABD$$

$$\overline{C} \cdot H \qquad \overline{D} \cdot H$$

A.H   B.H   C. H   D .H

$\overline{ACD}$

$\overline{BCD}$

$\overline{ABC}$

$\overline{ABD}$

ACD + BCD + ABC.H

Z.H

Z.H = ACD + BCD + ABC + ABD.H

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