Digital Logic Problem Set #3

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1. (58 points) Find minimal equations for the systems shown.

A \ B	0	1
0	0	1
1	1	1

F_{SOP}=
F_{POS}=

A \ B	0	1
0	1	1
1	1	0

F_{SOP}=
F_{POS}=

A \ B	0	1
0	0	1
1	1	0

F_{SOP}=
F_{POS}=

A \ B	0	1
0	1	0
1	0	1

F_{SOP}=
F_{POS}=

A \ BC	00	01	11	10
0	1	0	0	1
1	1	1	0	1

F_{SOP}=

A \ BC	00	01	11	10
0	1	0	0	1
1	1	1	0	1

F_{POS}=

A \ BC	00	01	11	10
0	1	0	1	0
1	1	1	1	1

F_{SOP}=

A \ BC	00	01	11	10
0	1	0	1	0
1	1	1	1	1

F_{POS}=

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

F_{SOP}=

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

F_{POS}=

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

F_{SOP}=

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

F_{POS}=

$F = \sum m(0, 1, 4, 5)$

$G = \prod M(0, 1, 3, 4, 5, 7, 13, 15)$

A \ BC	00	01	11	10
0				
1				

F_{SOP}=

A \ BC	00	01	11	10
0				
1				

F_{POS}=

AB \ CD	00	01	11	10
00				
01				
11				
10				

F_{SOP}=

AB \ CD	00	01	11	10
00				
01				
11				
10				

F_{POS}=

2. (58 points) Loop the logic graphs and find minimal equations for the systems shown below. Circle the equation of the simplest form (SOP or POS), and circle both if they are equal.

A \	0	1
0	0	1
1	1	ϕ

F_{SOP}=
F_{POS}=

A \	0	1
0	1	1
1	1	ϕ

F_{SOP}=
F_{POS}=

A \	0	1
0	0	1
1	ϕ	0

F_{SOP}=
F_{POS}=

A \	0	1
0	1	0
1	ϕ	1

F_{SOP}=
F_{POS}=

A \ BC	00	01	11	10
0	1	0	ϕ	1
1	1	ϕ	0	1

F_{SOP}=

A \ BC	00	01	11	10
0	1	0	ϕ	1
1	1	ϕ	0	1

F_{POS}=

A \ BC	00	01	11	10
0	1	ϕ	1	0
1	1	1	1	1

F_{SOP}=

A \ BC	00	01	11	10
0	1	ϕ	1	0
1	1	1	1	1

F_{POS}=

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

F_{SOP}=
F_{POS}=

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

F_{POS}=

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

F_{SOP}=
F_{POS}=

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

F_{POS}=

$F = \sum m(0, 1, 4, 5) + \phi\ (2, 7)$

$G = \prod M(0, 1, 4, 5, 7, 13, 15) + \phi\ (2, 3, 11, 12, 14)$

A \ BC	00	01	11	10
0				
1				

F_{SOP}=
F_{POS}=

A \ BC	00	01	11	10
0				
1				

AB \ CD	00	01	11	10
00				
01				
11				
10				

F_{SOP}=
F_{POS}=

AB \ CD	00	01	11	10
00				
01				
11				
10				

3. (20 points) Find minimal SOP and POS equations for the systems shown.

A \ B C	00	01	11	10
0	1	1	D	1
1	1	$\bar{D}$	0	1

F_{POS}=

A \ B C	00	01	11	10
0	D	D	E	E
1	D	D	E	1

F_{SOP}=

A B \ C D	00	01	11	10
00	1	ϕ	ϕ	1
01	0	E	E	E
11	ϕ	1	1	0
10	0	$\bar{E}$	$\bar{E}$	0

F_{POS}=

A B \ C D	00	01	11	10
00	1	ϕ	ϕ	1
01	0	E	E	E
11	ϕ	1	1	0
10	0	$\bar{E}$	$\bar{E}$	0

F_{SOP}=

4. (15 points) Find global minimum circuits for the following three logic signal outputs that are all functions of the same three inputs. Show all work.

$F1 = \sum m\,(0, 3, 4)$ $F2 = \sum m\,(1, 6, 7)$ $F3 = \sum m\,(0, 1, 3, 4)$