

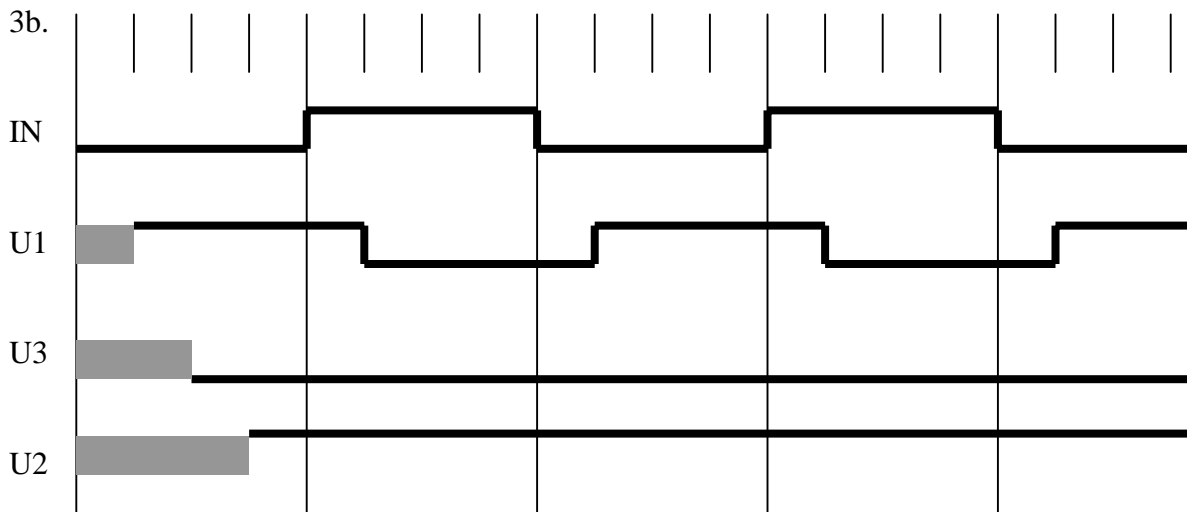
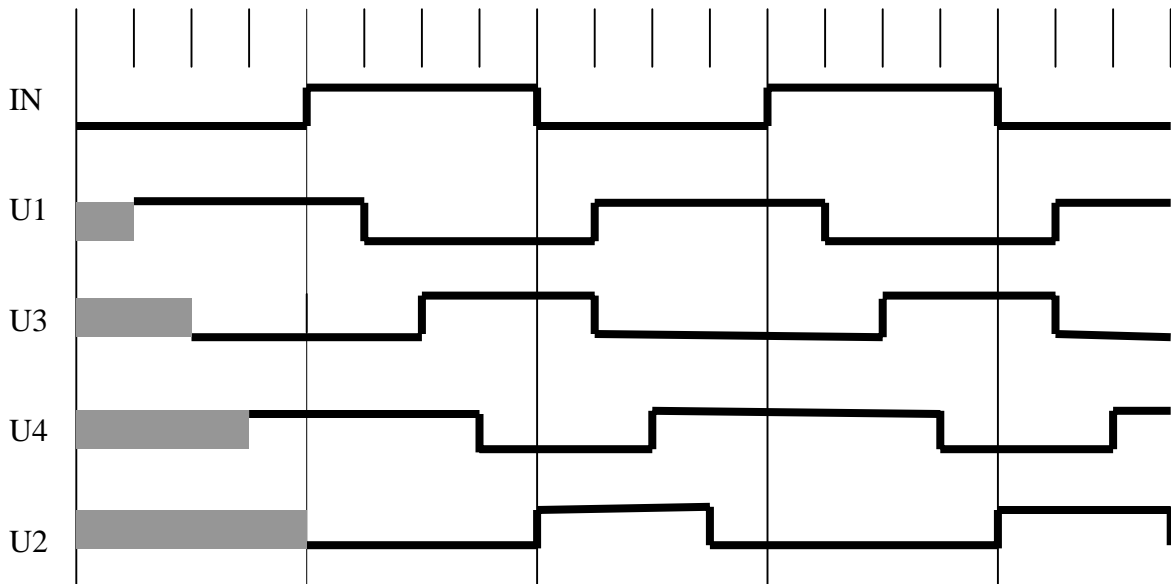
University of California at Berkeley
College of Engineering
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EECS 150
Fall 2000

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Problem Set # 3 Solution

3a. Assume each gate has the same delay.

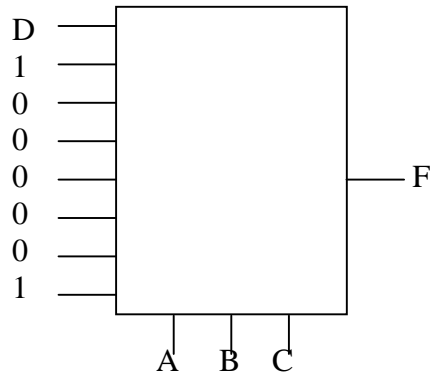


This circuit does not have an oscillating output. Since signal U2 is high all the time, signal U3 will remain low and is constant, independent of signal U1.

4.

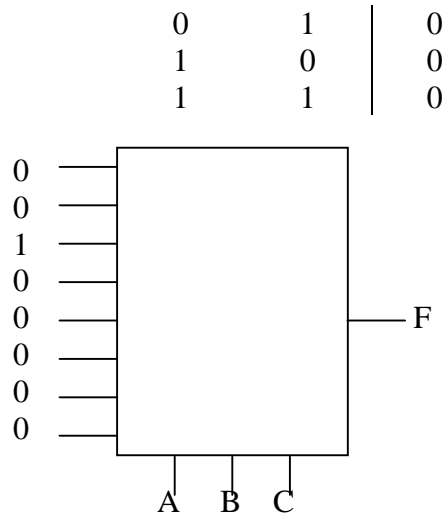
1a) $F(A,B,C,D) = (ABC + A'B')(C+D)$

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



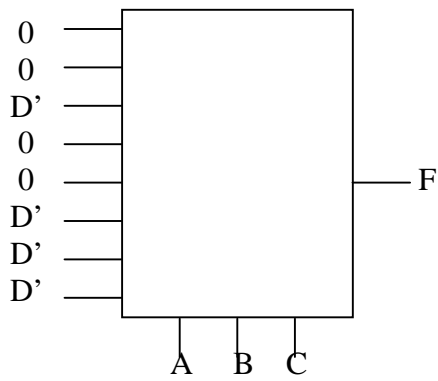
1b) $G(B,C) = B'C'$; $F(A,B,C,D) = [(A+B)(A'+C) + G]G'(A'C' + G)$

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



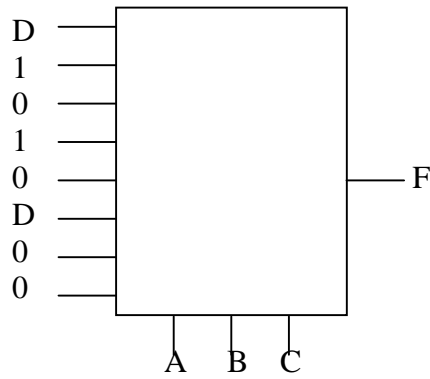
$$1c) F(A,B,C,D) = [A' + B' + C] (B + C') (C + D')' (A + B' + C')' + ACD' + BC'D'$$

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



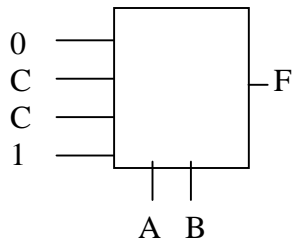
$$2c) F(A,B,C,D) = B'CD + A'B'D + A'C$$

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



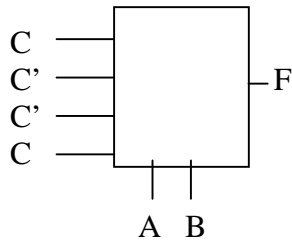
$$2a) F(A,B,C) = AB + BC + AC$$

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



$$2b) F(A,B,C) = A'B'C + A'BC' + AB'C' + ABC$$

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



5. First, you have to write out the truth tables for each function and use K-map to reduce their sum of product forms.

$$1a. F(A,B,C,D) = (ABC+A'B')(C+D) \\ = A'B'C'D + A'B'CD' + A'B'CD + ABCD' + ABCD \\ = ABC + A'B'C + A'B'D$$

$$1b. G(B,C) = B'C'; F(A,B,C,D) = [(A+B)(A'+C) + G]G'(A'C' + G) \\ = A'BC'D' + A'BC'D \\ = A'BC'$$

$$1c. F(A,B,C,D) = [A'+B'+C)(B+C')(C+D)'](A+B'+C)'] + ACD' + BC'D' \\ = A'BC'D' + AB'CD' + ABC'D' + ABCD' \\ = BC'D' + ACD'$$

$$2a. F(A,B,C) = AB + BC + AC$$

2b. $F(A,B,C) = A'B'C + A'BC' + AB'C' + ABC$

2c. $F(A,B,C,D) = B'CD + A'B'D + A'C$

Distinct Products Terms in the above equations:

ABC A'B'C A'BC' AB'C' A'B'D ACD' BC'D' B'CD A'C AC AB BC

