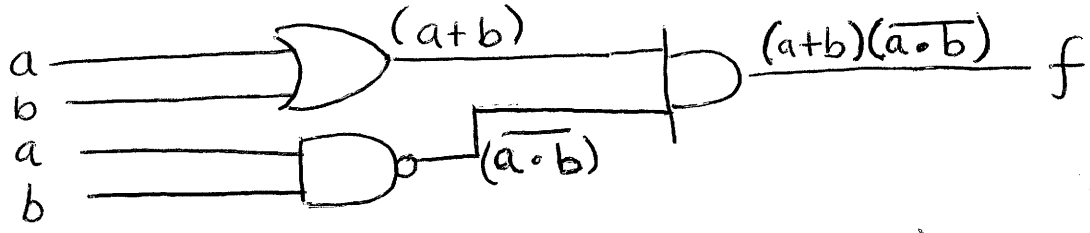
SOLUTIONS

EECS 281: Homework #1 **Due: Tuesday, January 18, 2004**

Name: _____ Email: _____

1. Given the boolean expression: $f(a,b) = (a+b)(\overline{a \cdot b})$

(a) Draw the logic gate schematic:



(b) Re-write as a C++/JAVA expression: $f =$ (a | b) & ~(a & b); /*bitwise*/

(c) Re-write as a VHDL expression: $f <=$ (a OR b) AND (a NAND b);

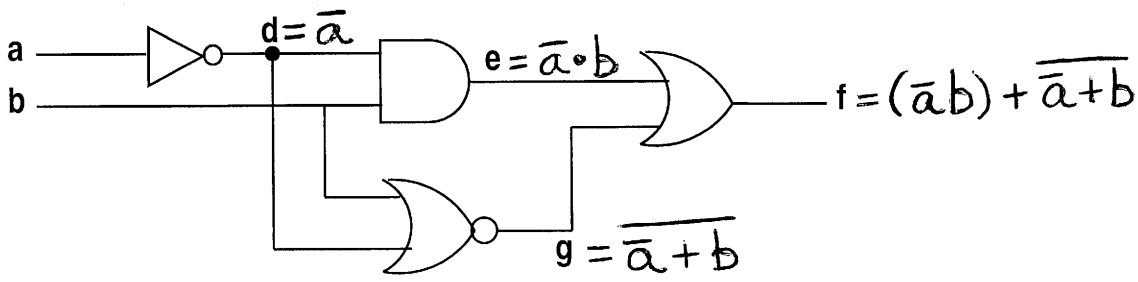
(d) Fill in the truth table

a b	$a+b$	$a \cdot b$	$\overline{a \cdot b}$	$f = (a+b)(\overline{a \cdot b})$
0 0	0	0	1	0
0 1	1	0	1	1
1 0	1	0	1	1
1 1	1	1	0	0

logical c++/Java expression

f = (a || b) && !(a && b);

2. Given the following logic circuit



(a) Give the truth table of a, b, c, d, e, g and f:

a	b	d=ā	e=āb	g=ā+b	f=āb+ā+b
0	0	1	0	0	0
0	1	1	1	0	1
1	0	0	0	1	1
1	1	0	0	0	0

(b) Give the boolean expression of e, g and f:

e= $\bar{a}b$

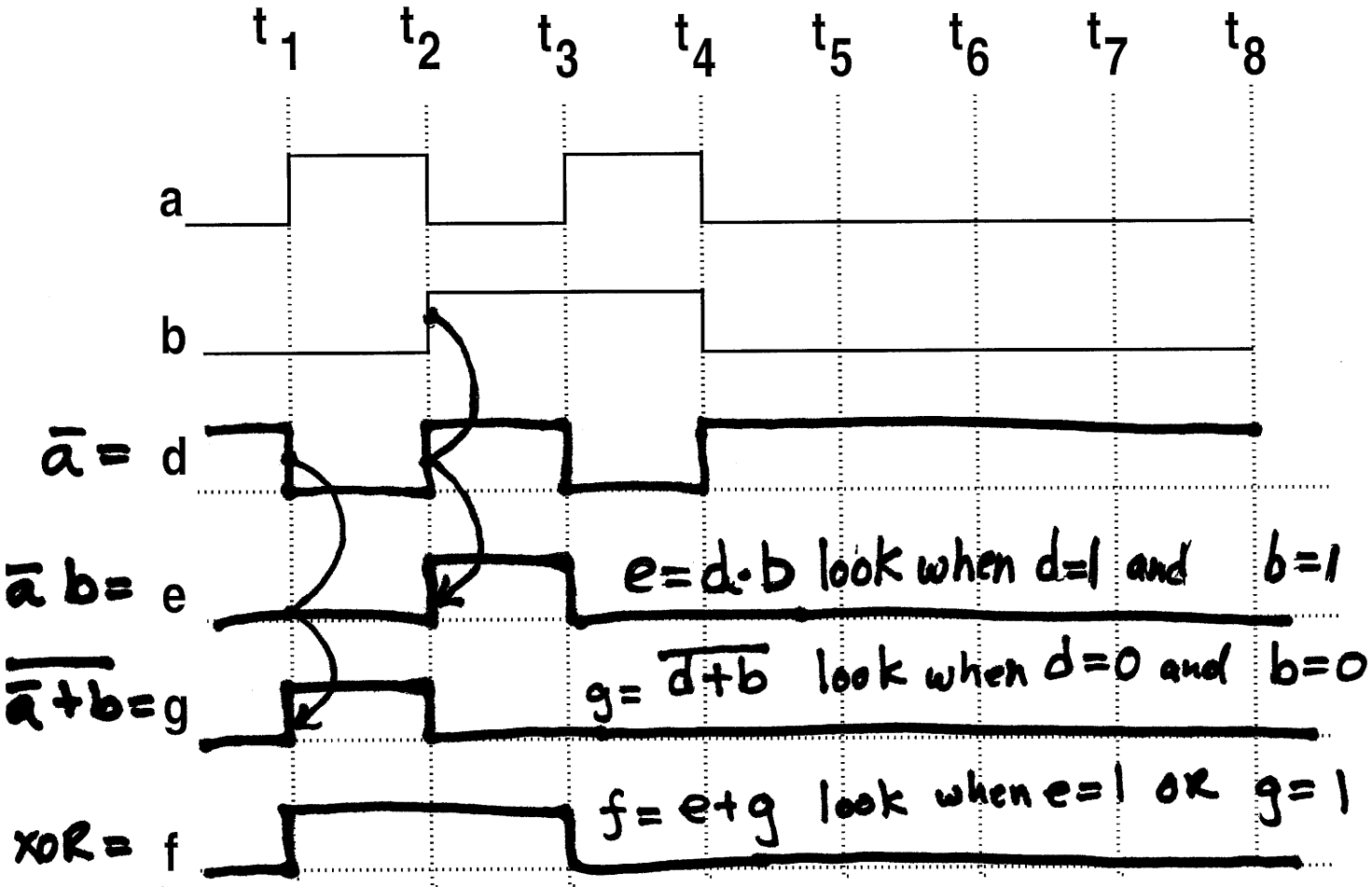
g= $\overline{\bar{a}+b}$

f= $\bar{a}b + \overline{\bar{a}+b}$

(c) Compare the truth table of part 1d with 2a. Are they the same? (Yes) or No.

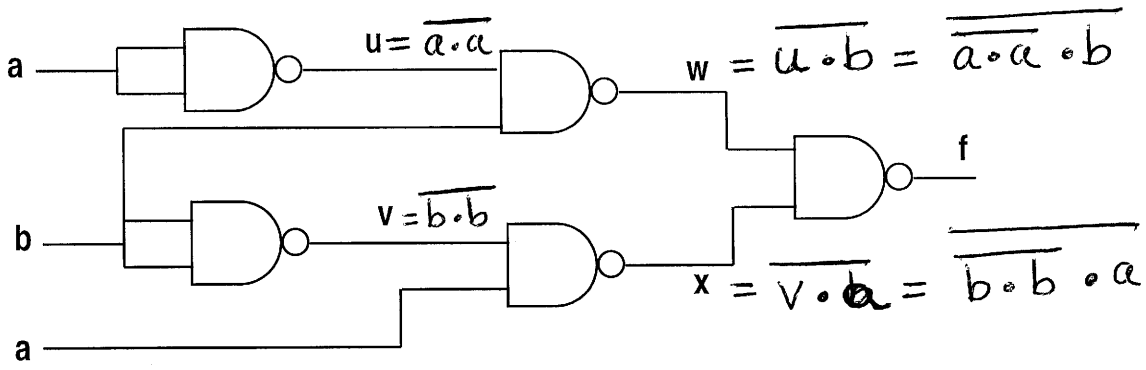
What other common logic function is $f(a, b)$ similar to? XOR

(d) Fill in the timing diagram including trigger lines (0 ns delay) for 2(a).



	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8
a	0	1	0	1	0	0	0	0	
b	0	0	1	1	0	0	0	0	
d	1	0	1	0	1	1	1	1	
e	0	0	1	0	0	0	0	0	
g	0	1	0	0	0	0	0	0	
f	0	1	1	0	0	0	0	0	

3. Given the following logic circuit



(a) Give the truth table of a, b, u, v, w, x and f:

a	b	$u = \overline{a \cdot a} = \overline{a}$	$v = \overline{b \cdot b} = \overline{b}$	$w = \overline{u \cdot b}$	$x = \overline{v \cdot a}$	$f = \overline{w \cdot x}$
0	0	1	1	1	1	0
0	1	1	0	0	1	1
1	0	0	1	1	0	1
1	1	0	0	1	1	0

(b) Give the boolean expression of $f(a, b)$ = _____

(c) Re-write as a C++/JAVA expression: f = _____

~(~(~(a &~a) &b) & ~(~(b &~b) &a));

(d) Re-write as a VHDL expression: f <= _____

((a NAND a) NAND b) NAND ((b NAND b) NAND a);

$u = \overline{a \cdot a}$

$v = \overline{b \cdot b}$

$w = \overline{u \cdot b} = \overline{\overline{a \cdot a} \cdot b}$

$x = \overline{v \cdot a} = \overline{\overline{b \cdot b} \cdot a}$

$f = \overline{w \cdot x} = \overline{(\overline{\overline{a \cdot a} \cdot b})(\overline{\overline{b \cdot b} \cdot a})}$