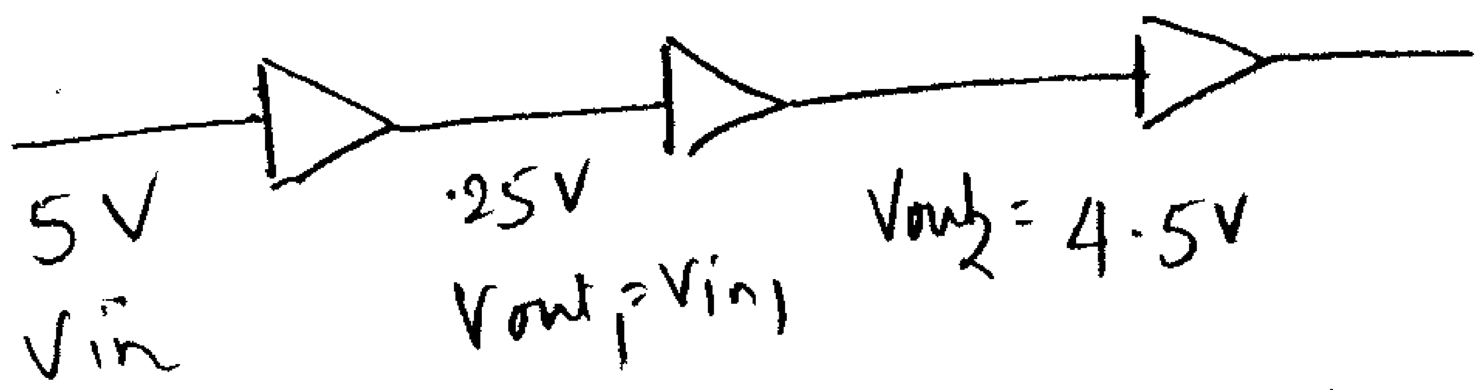
Ans 1 ÷ (a) Yes this logic can be safely used to implement all Boolean functions. From the transfer function, given $V_{in} = V_{DD} = 5V$ and $V_{in} = 0V$ we can get $V_{out} = .25V$ and $V_{out} = 4.75V$ which can be safely classified as logic-lo and logic-hi. Thus safe implementation upto three levels of logic are possible.

(b) No, this logic can't be safely and efficiently used to implement all Boolean functions. Take an inverter chain:



There is a decrease in voltage and at one point the voltage vestoration. 2·5V will go to 2·5V, & after that there is no voltage can't be classified as either logic-hi or logic-lo

Ans 2 ÷ $f(a,b,c,d) = \sum(0,4,5,6,7,11,12,14,15) + d(2,3,13)$

cd \ ab	00	01	11	10
00	1	1	1	
01		1	X	
11	X	1	1	1
10	X	1	1	

① b –

② cd

③ $\bar{a}\,\bar{d}$

$f(a,b,c,d) = (b + cd + \bar{a}\bar{d})$

3. $f(a,b,c) = \sum(1,2,4,5) + d(3)$

$\Sigma=1$	001	0x1
	010	x01
	100	01x
$\Sigma=2$	011	10x
	101	

	0x1	x01	01x	10x
001	✓	✓		
010			✓	
100				✓
101		✓		✓

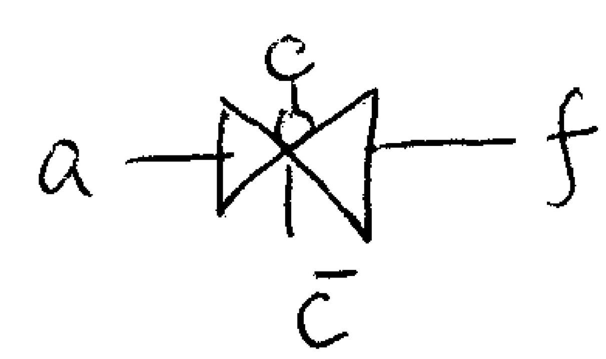
$f(a,b,c) = \bar{b}c + \bar{a}b + a\bar{b}$

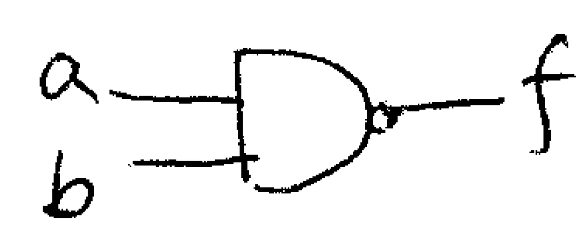
or $= \bar{a}c + \bar{a}b + a\bar{b}$

5. No, by comparing the truth table of Transmission Gate and 2-input NAND GATE, we can find that NAND does not have High-Z, which is necessary for TG.

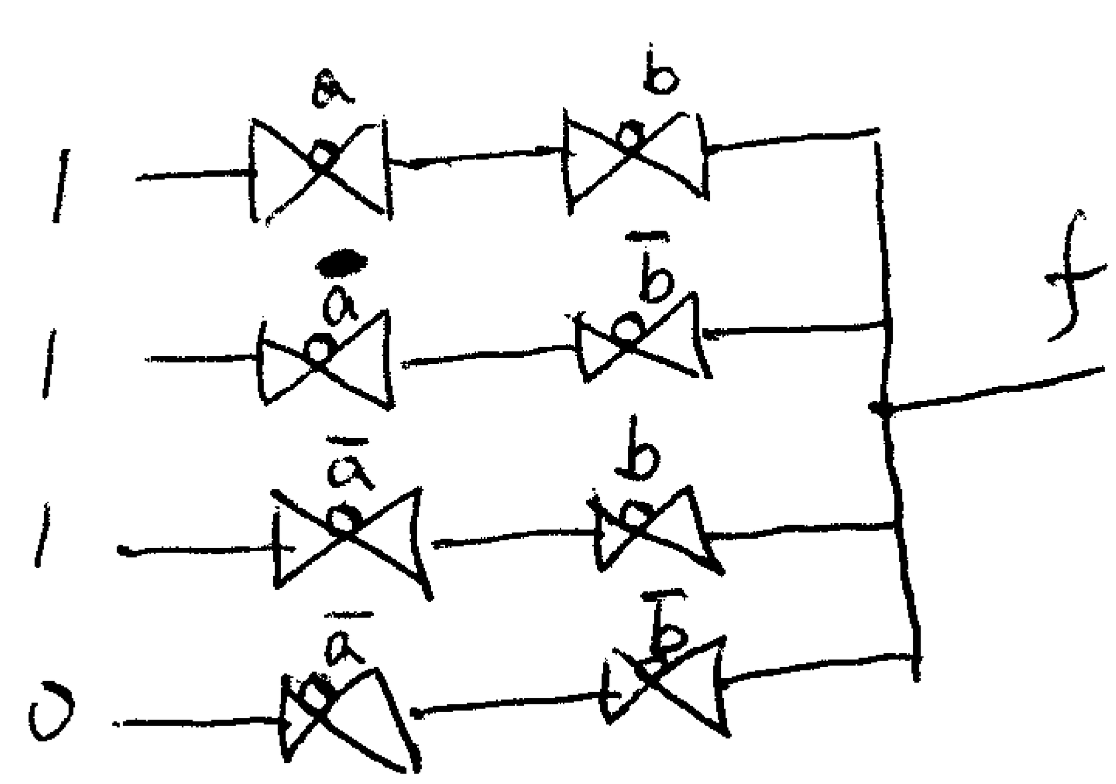
a	b	f
0	0	1
0	1	1
1	0	1
1	1	0

a	c	f
0	0	0
0	1	High-Z
1	0	1
1	1	High Z.

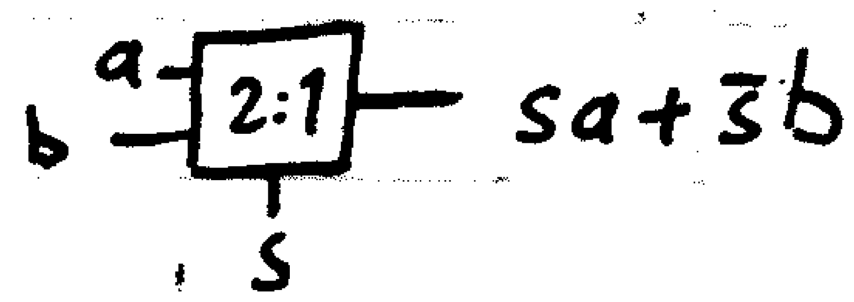




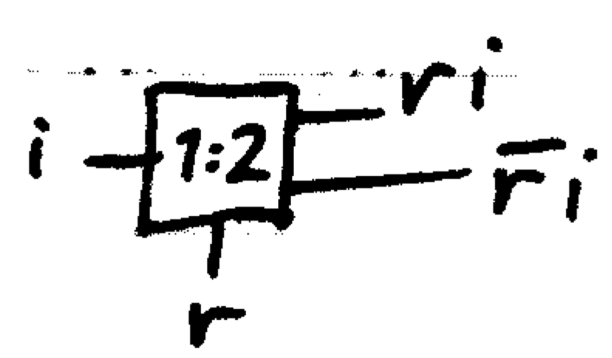
6. Yes.



4) For 2:1 MUX

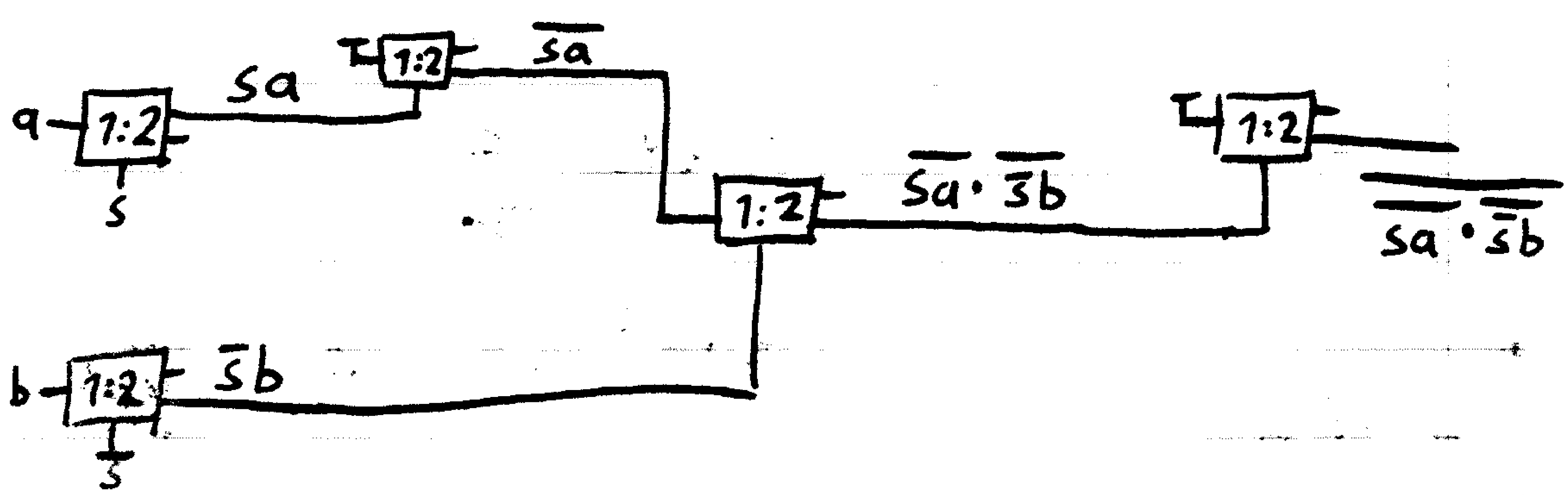


Can use 1:2 DMUX only

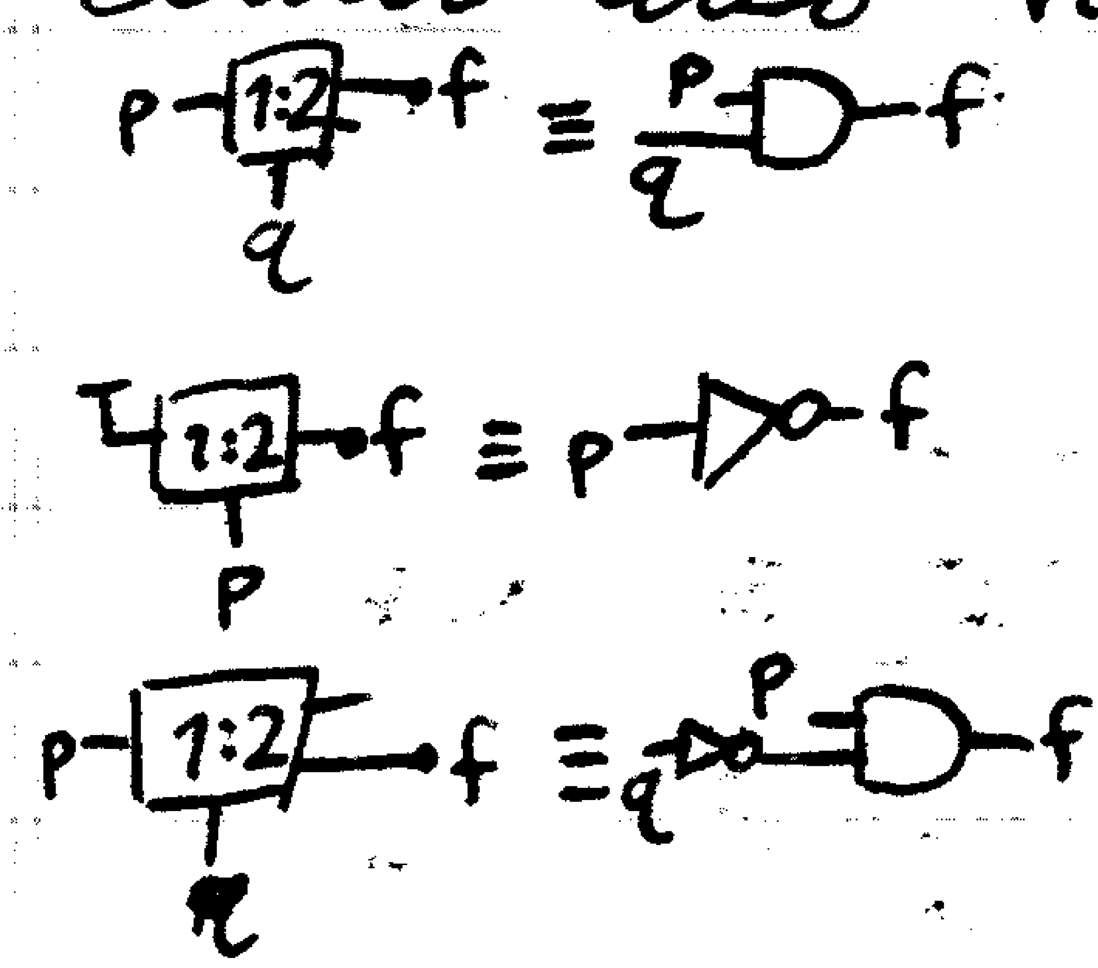


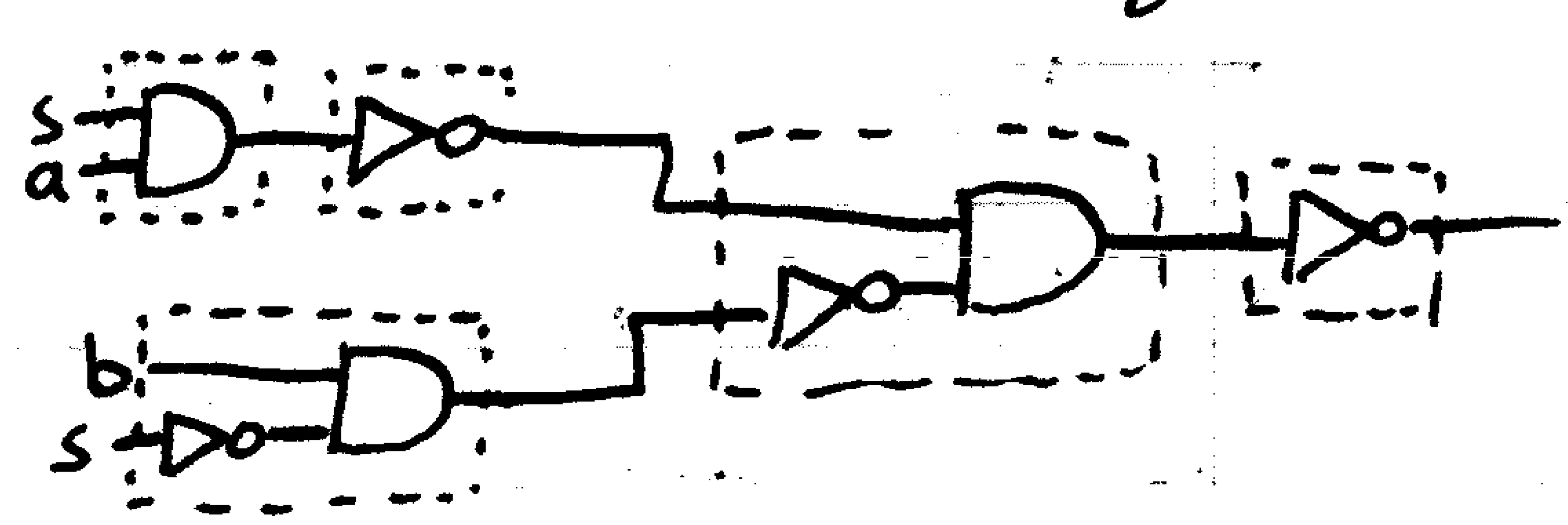
Building blocks: $ri, \bar{r}i$

$$f = sa + \bar{s}b = \overline{\overline{sa+\bar{s}b}} = \overline{\overline{sa} \cdot \overline{\bar{s}b}}$$



Could also view problem this way:





7)