Computer Science CSCI 355

Digital Logic and Computer Organization

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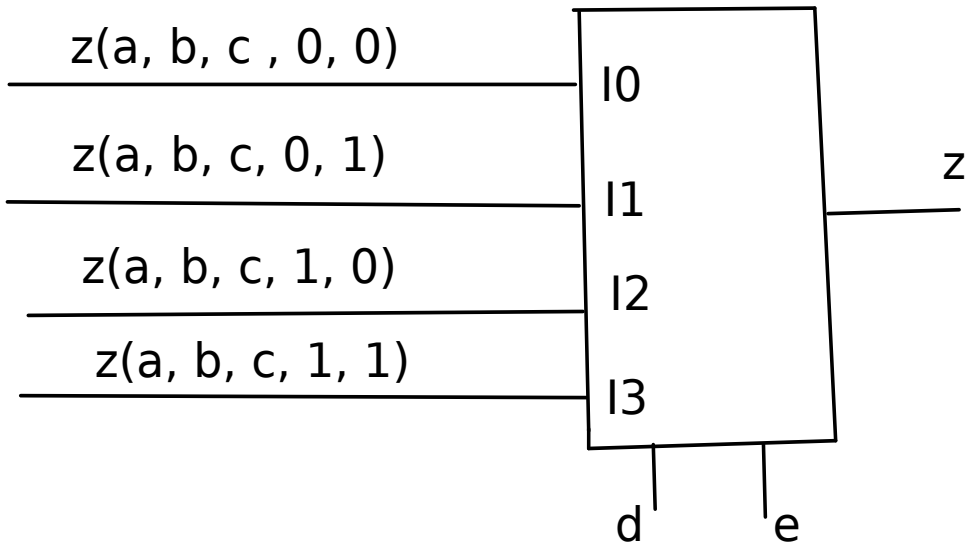
Multiplexors cont.

◯ e.g. Implement $z(a, b, c, d, e)$ using 3 4-to-1 multiplexors

			d e				
			I0	I1	I2	I3	
a	b	c	00	01	10	11	
0	0	0	0	0	0	1	1
0	0	1	0	1	1	1	
0	1	0	0	1	1	1	
0	1	1	1	1	1	1	
1	0	0	0	1	1	1	
1	0	1	1	1	1	1	
1	1	0	1	1	1	1	
1	1	1	1	1	1	1	

Multiplexors cont.

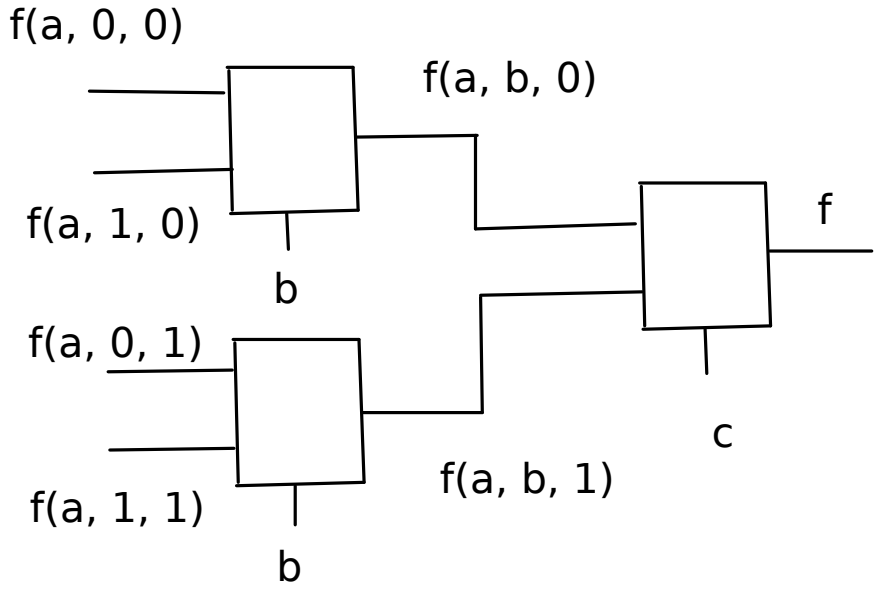
◯ e.g. Implement $z(a, b, c, d, e)$ using 3 4-to-1 multiplexors



Shannon's Decomposition Theorem

$$f(x_1, x_2, ..., x_n) = x_1\ f(1, x_2, ..., x_n) + \overline{x_1}\ f(0, x_2, ..., x_n)$$

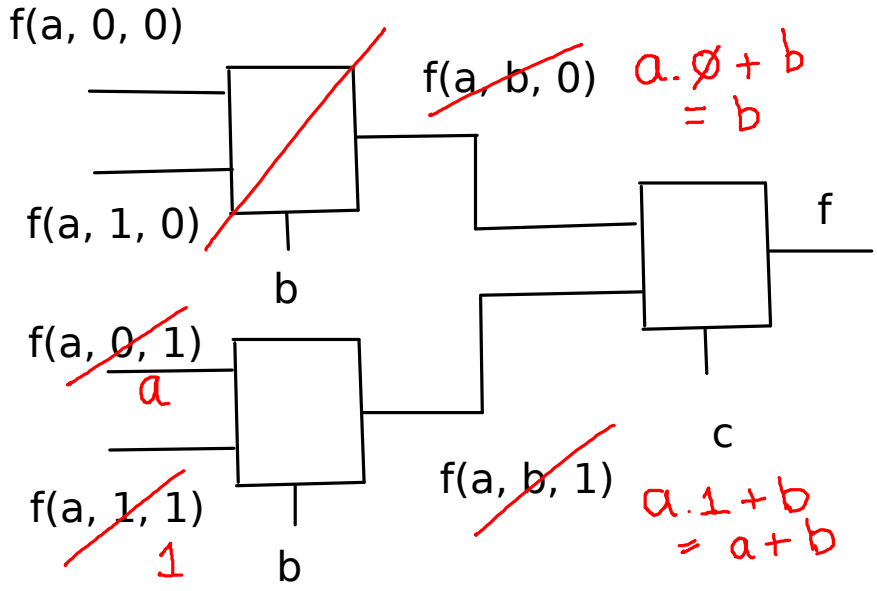
◯ e.g. $f(a, b, c)$



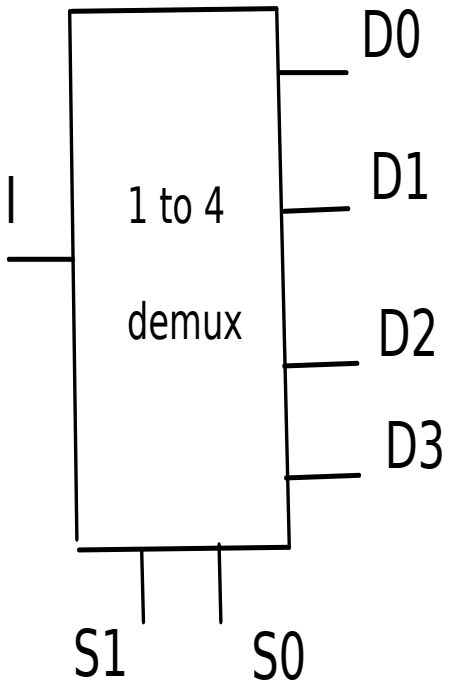
Shannon's Decomposition Theorem cont.

$f(x_1, x_2, ..., x_n) = x_1\ f(1, x_2, ..., x_n) + \overline{x_1}\ f(0, x_2, ..., x_n)$

◯ e.g. $f(a, b, c) = ac + b$

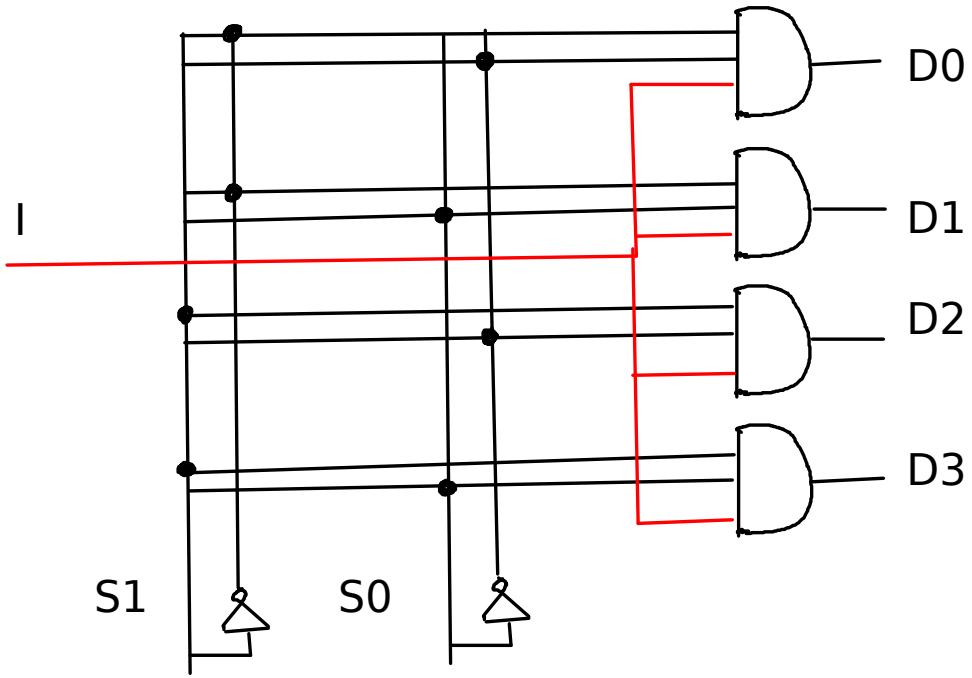


DeMultiplexor

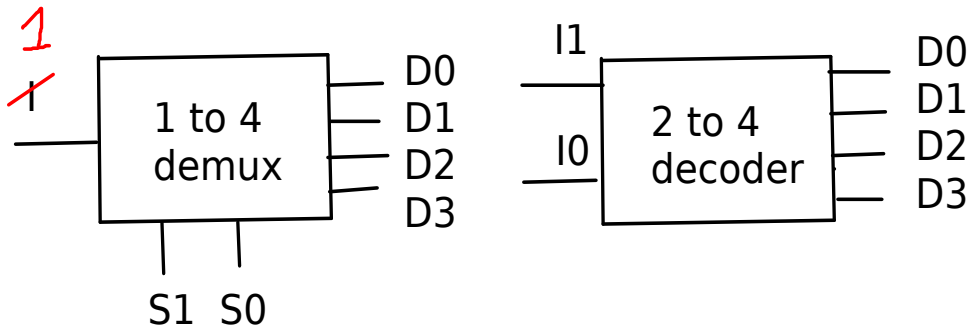


S1	S0	D0	D1	D2	D3
0	0	I	0	0	0
0	1	0	I	0	0
1	0	0	0	I	0
1	1	0	0	0	I

DeMultiplexor cont.

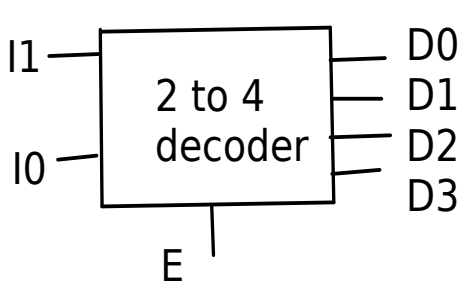


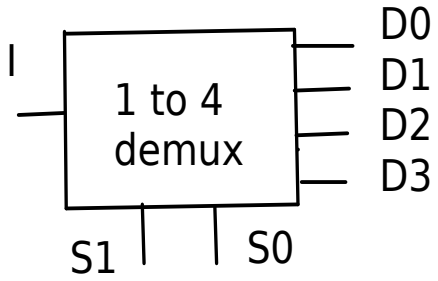
DeMultiplexor as a Decoder



S1	S0	I1	I0	D0	D1	D2	D3
0	0	0	0	1	0	0	0
0	1	0	1	0	1	0	0
1	0	1	0	0	0	1	0
1	1	1	1	0	0	0	1

Decoder as a DeMultiplexor

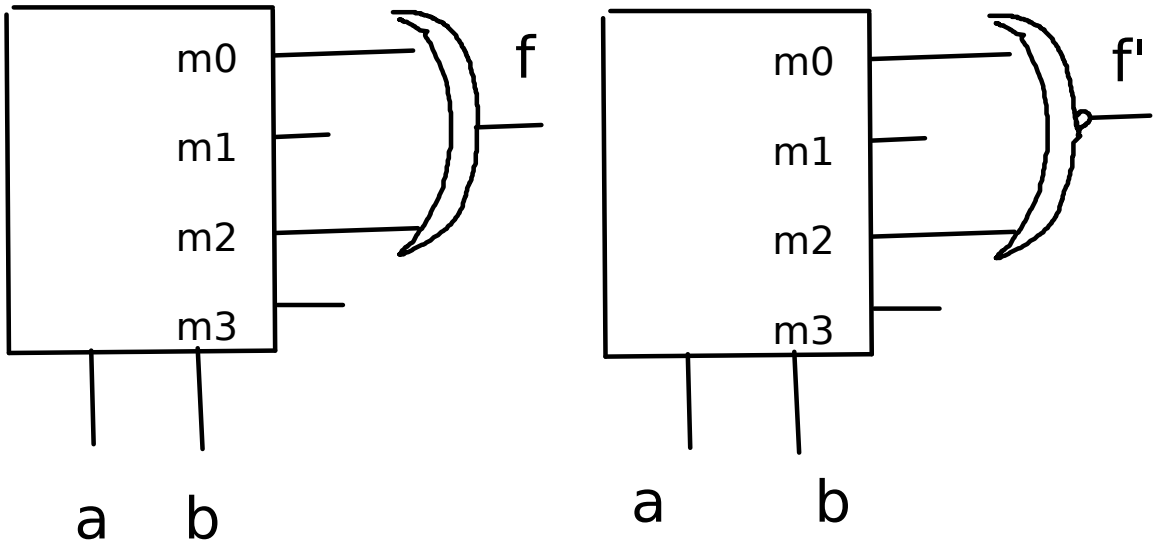




I1	I0	E	S1	S0	I	D0	D1	D2	D3
-	-	0	-	-	0	0	0	0	0
0	0	1	0	0	1	1	0	0	0
0	1	1	0	1	1	0	1	0	0
1	0	1	1	0	1	0	0	1	0
1	1	1	1	1	1	0	0	0	1

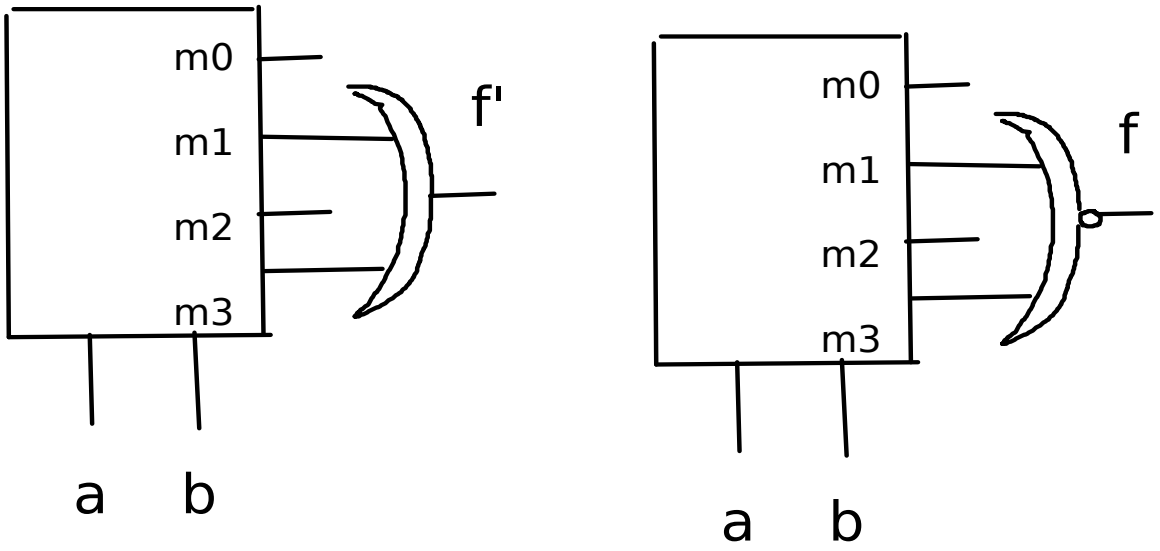
Decoders cont.

- Implement $f(a, b) = \Sigma m\ (0, 2)$



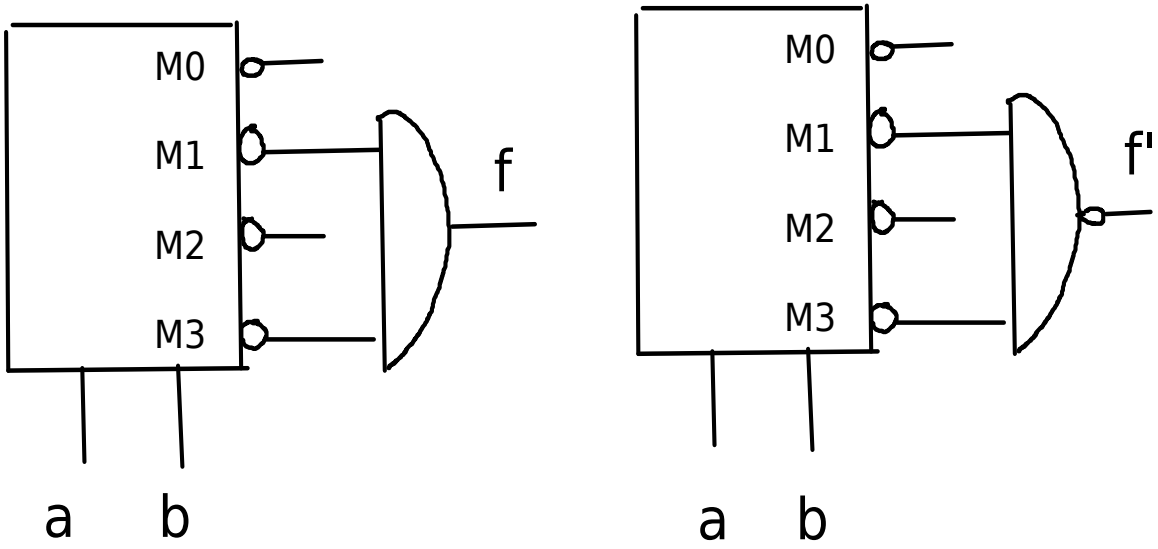
Decoders cont.

- Implement $f(a, b) = \Sigma m\ (0, 2)$



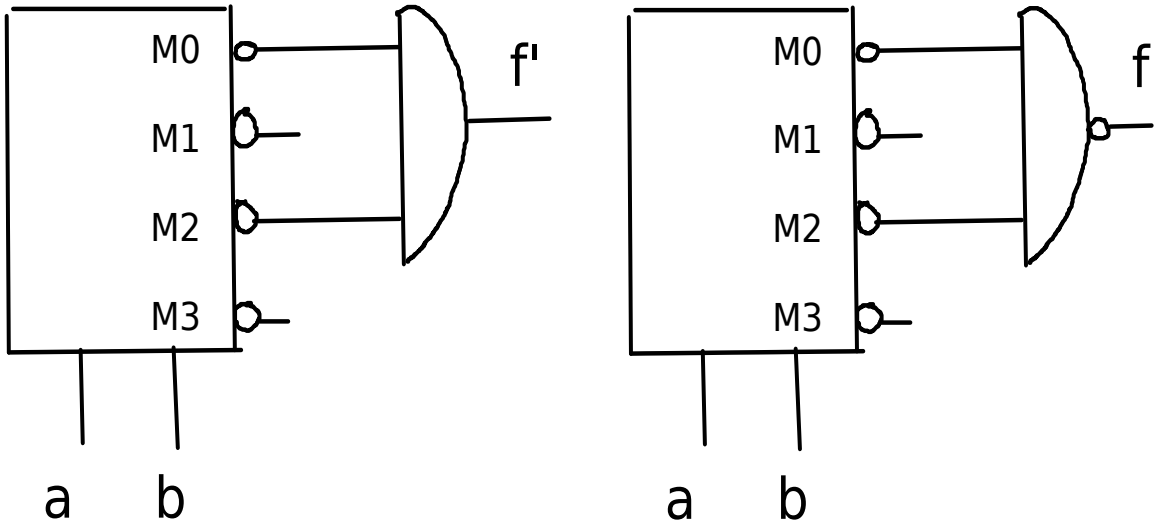
Decoders cont.

- Implement $f(a, b) = \Sigma m\ (0, 2)$



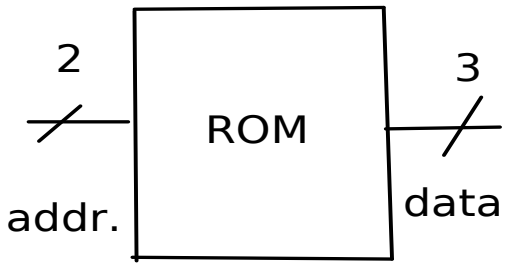
Decoders cont.

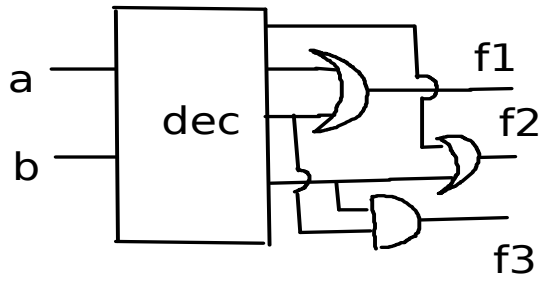
- Implement $f(a, b) = \Sigma m\ (0, 2)$



Read Only Memory (ROM)

- Implement 2^2 x 3 ROM





a	b	f1	f2	f3
0	0	0	1	0
0	1	1	0	0
1	0	1	0	1
1	1	0	1	1