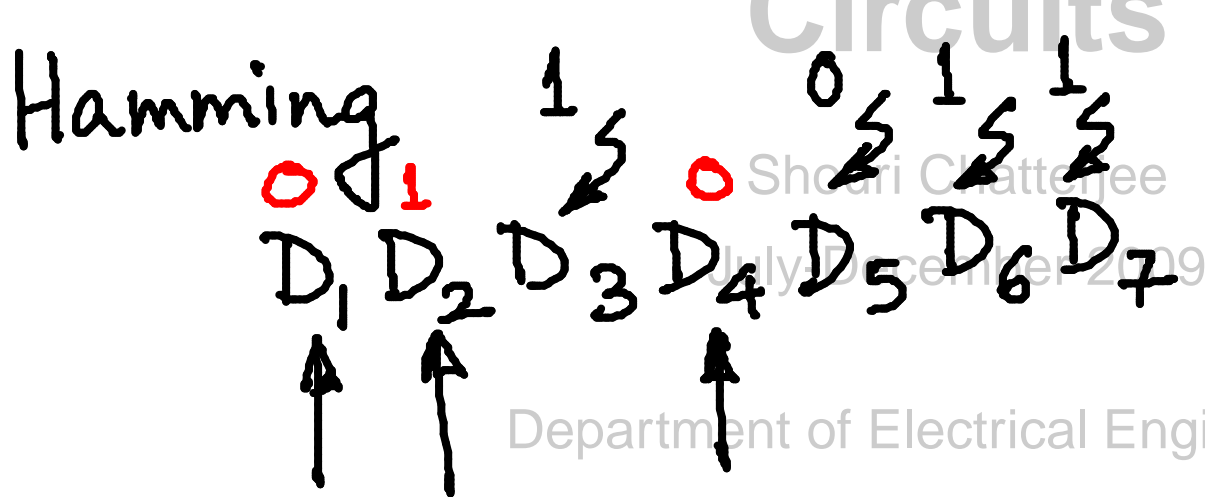


# Error correction

- Out of 7 bits, 3 code bits, 4 message bits
- Out of 15 bits, 4 code bits, 11 message bits



$$D_1 = \text{XOR}(D_3, D_5, D_7)$$
$$D_2 = \text{XOR}(D_3, D_6, D_7)$$
$$D_4 = \text{XOR}(D_5, D_6, D_7)$$

	D <sub>4</sub>	D <sub>2</sub>	D <sub>1</sub>
1 →	0	0	1
2 →	0	1	0
3 →	0	1	1
⋮	1	0	0
⋮	1	0	1
⋮	1	1	0
7 →	1	1	1

$$E_1 = \text{XOR}(R_1, R_3, R_5, R_7) \leftarrow$$

$$E_2 = \text{XOR}(R_2, R_3, R_6, R_7) \leftarrow$$

$$E_4 = \text{XOR}(R_4, R_5, R_6, R_7)$$

	$E_4$	$E_2$	$E_1$
$R_5 \leftarrow$	1	0	1
$R_2 \leftarrow$	0	1	0
$R_7 \leftarrow$	1	1	1

0 1 1 0 0 0 1

$R_1$   $R_2$   $R_3$   $R_4$   $R_5$   $R_6$   $R_7$

Shouri Chatterjee

July-December 2009

$$E_1 = \text{XOR}(0, 1, 0, 1) = 0$$

$$E_2 = \text{XOR}(1, 1, 0, 1) = 1$$

$$E_4 = \text{XOR}(0, 0, 0, 1) = 1$$



Department of Electrical Engineering,  
Indian Institute of Technology, Delhi,  
Hauz Khas, New Delhi 110016

D<sub>1</sub> D<sub>2</sub> D<sub>3</sub> D<sub>4</sub> D<sub>5</sub> D<sub>6</sub> D<sub>7</sub> D<sub>8</sub> D<sub>9</sub> D<sub>10</sub> D<sub>11</sub> D<sub>12</sub> D<sub>13</sub> D<sub>14</sub> D<sub>15</sub>

↑ ↑ ↑ ↑

$$D_1 = \text{XOR}(D_3, D_5, D_7, D_9, D_{11}, D_{13}, D_{15})$$

$$D_2 = \text{XOR}(D_3, D_6, D_7, D_{10}, D_{11}, D_{14}, D_{15})$$

$$D_4 = \text{XOR}(D_5, D_6, D_7, D_{12}, D_{13}, D_{14}, D_{15})$$

$$D_8 = \text{XOR}(D_9, D_{10}, D_{11}, D_{12}, D_{13}, D_{14}, D_{15})$$

$$D_{16} = \text{XOR}(D_1, \dots, D_{15})$$

$$E_1 = \text{XOR}(R_1, 3, 5, 7, 9, 11, 13, 15)$$

$$E_2 = \text{XOR}(R_2, 3, 6, 7, 10, 11, 14, 15)$$

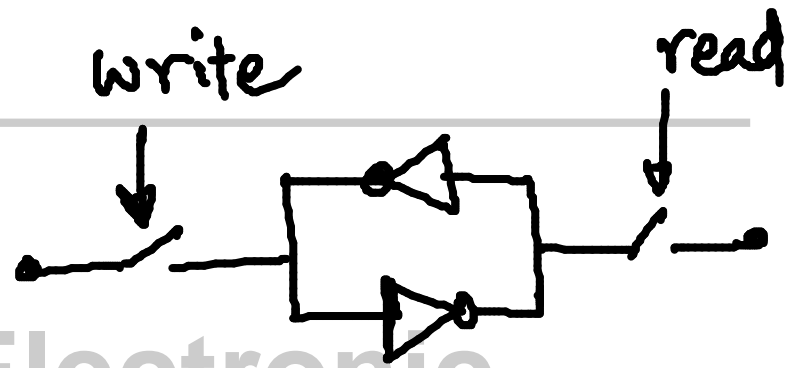
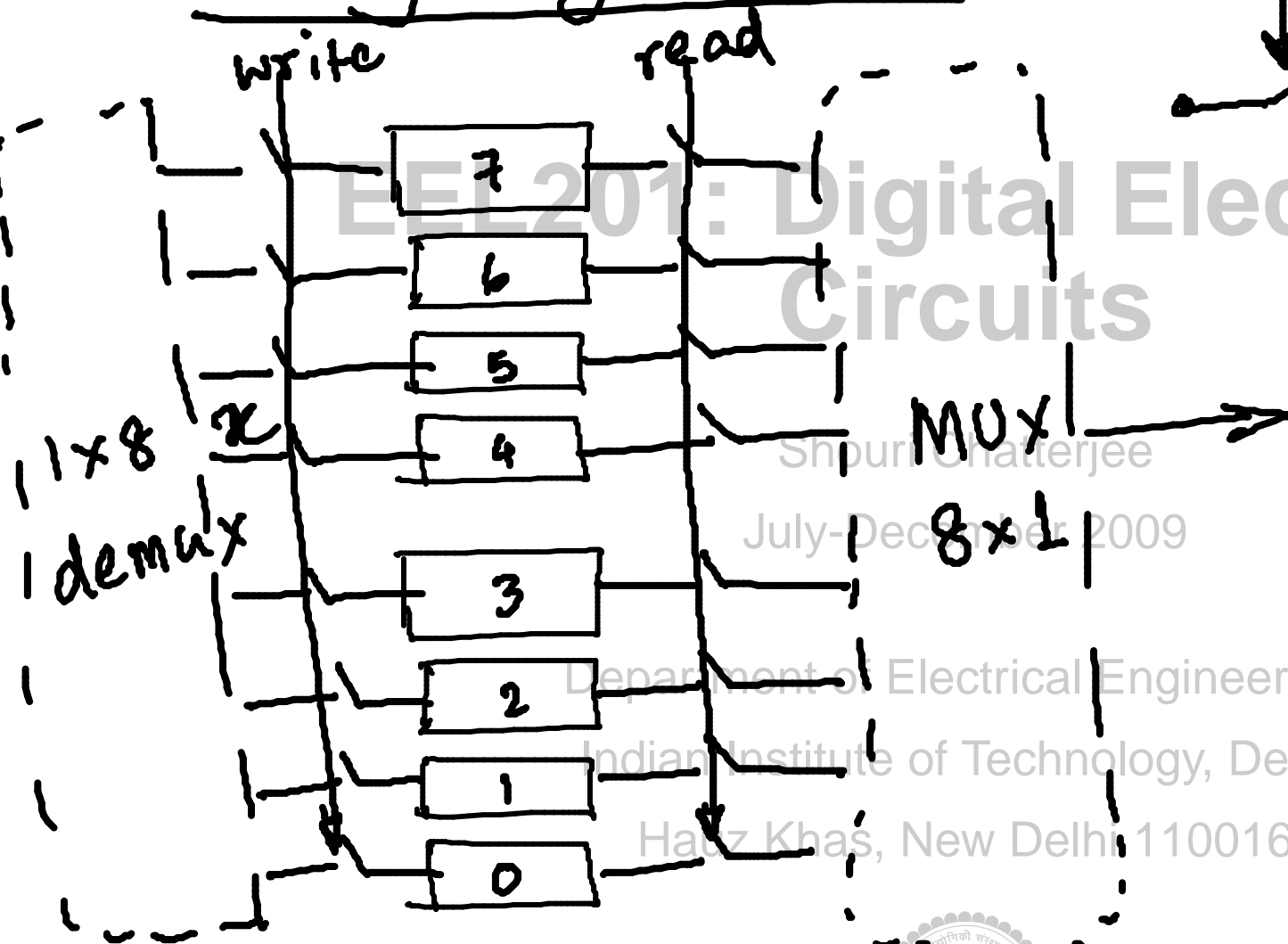
$$E_4 = \text{XOR}(R_4, 5, 6, 7, 12, 13, 14, 15)$$

$$E_8 = \text{XOR}(R_8, 9, 10, 11, 12, 13, 14, 15)$$

$$E_{16} = \text{XOR}(R_1, \dots, 16)$$



# Memory organization



EEL201: Digital Electronic Circuits

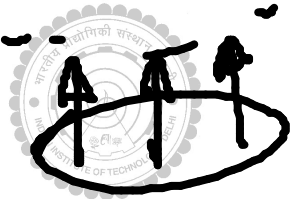
Shruti Chatterjee

July-December 2009

Department of Electrical Engineering,

Indian Institute of Technology, Delhi,

Hauz Khas, New Delhi 110016



1 k-bit

1024 bits

$(2^{10})$

2AA

COLUMN DECODER

10th row

10th row

