

## HW7 solution

1. The memory units that follow are specified by the number of words times the number of bits per word. (1) How many address lines and input-output lines are needed in each case? (2) Give the number of bits stored in the memories in each case. (a) 4M x 16 (b) 1G x 8.

(a)

$$\begin{array}{cc} \underline{\underline{4\text{M}}} & \times & \underline{\underline{16}} \\ \downarrow & & \downarrow \\ \text{address} & & \text{data} \end{array}$$

(1)  $4 \times 2^{20} = 2^{22} \Rightarrow 22 \text{ address lines}$   
 16 data input lines  
 16 data output lines

(2)  $2^{22} \times 2^4 = 2^{26} \text{ bits}$

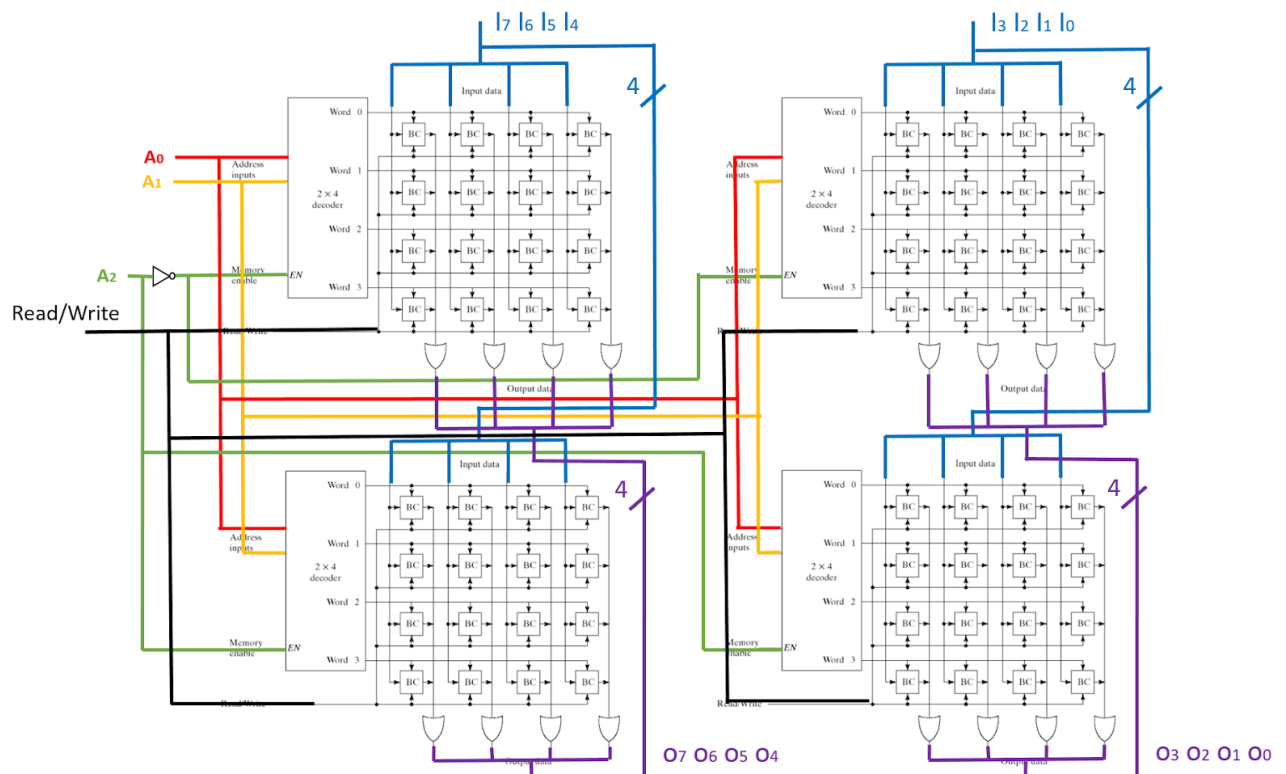
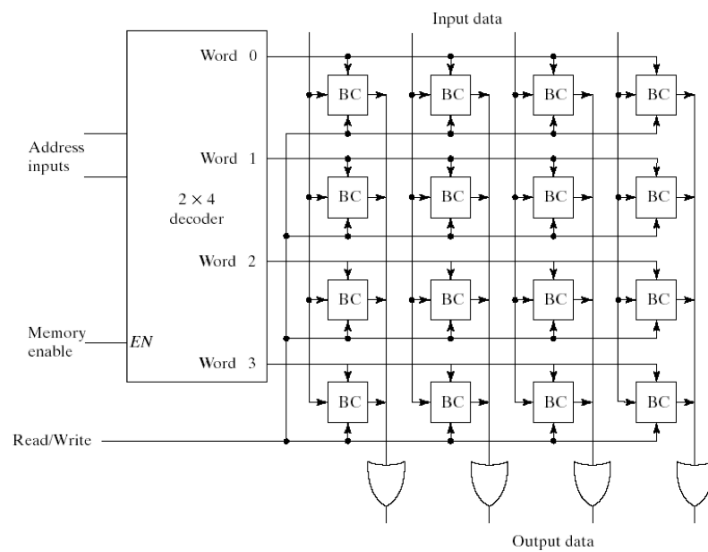
(b)

$$\begin{array}{cc} \underline{\underline{1\text{G}}} & \times & \underline{\underline{8}} \\ \downarrow & & \downarrow \\ \text{address} & & \text{data} \end{array}$$

(1)  $1 \times 2^{30} = 2^{30} \Rightarrow 30 \text{ address lines}$   
 8 data input lines  
 8 data output lines

(2)  $2^{30} \times 2^3 = 2^{33} \text{ bits}$

2. Enclose the 4x4 RAM of figure below, in a block diagram showing all inputs and outputs. Assuming three-state outputs, construct an 8x8 memory using four 4x4 RAM units. (Hint: Similar to decoder size extension in decoder with enable input)



3. Tabulate the truth table for an 8x4 ROM that implements the Boolean functions.

(1)  $A(X, Y, Z) = \Sigma m(1, 3, 5)$

(2)  $D(X, Y, Z) = \Sigma m(2, 3, 5, 6, 7)$

3.

X	Y	Z	A	D
0	0	0	0	0
0	0	1	1	0
0	1	0	0	1
0	1	1	1	1
1	0	0	0	0
1	0	1	1	1
1	1	0	0	1
1	1	1	0	1