INTRODUCTION TO MICROCOMPUTERS FIRST EXAM

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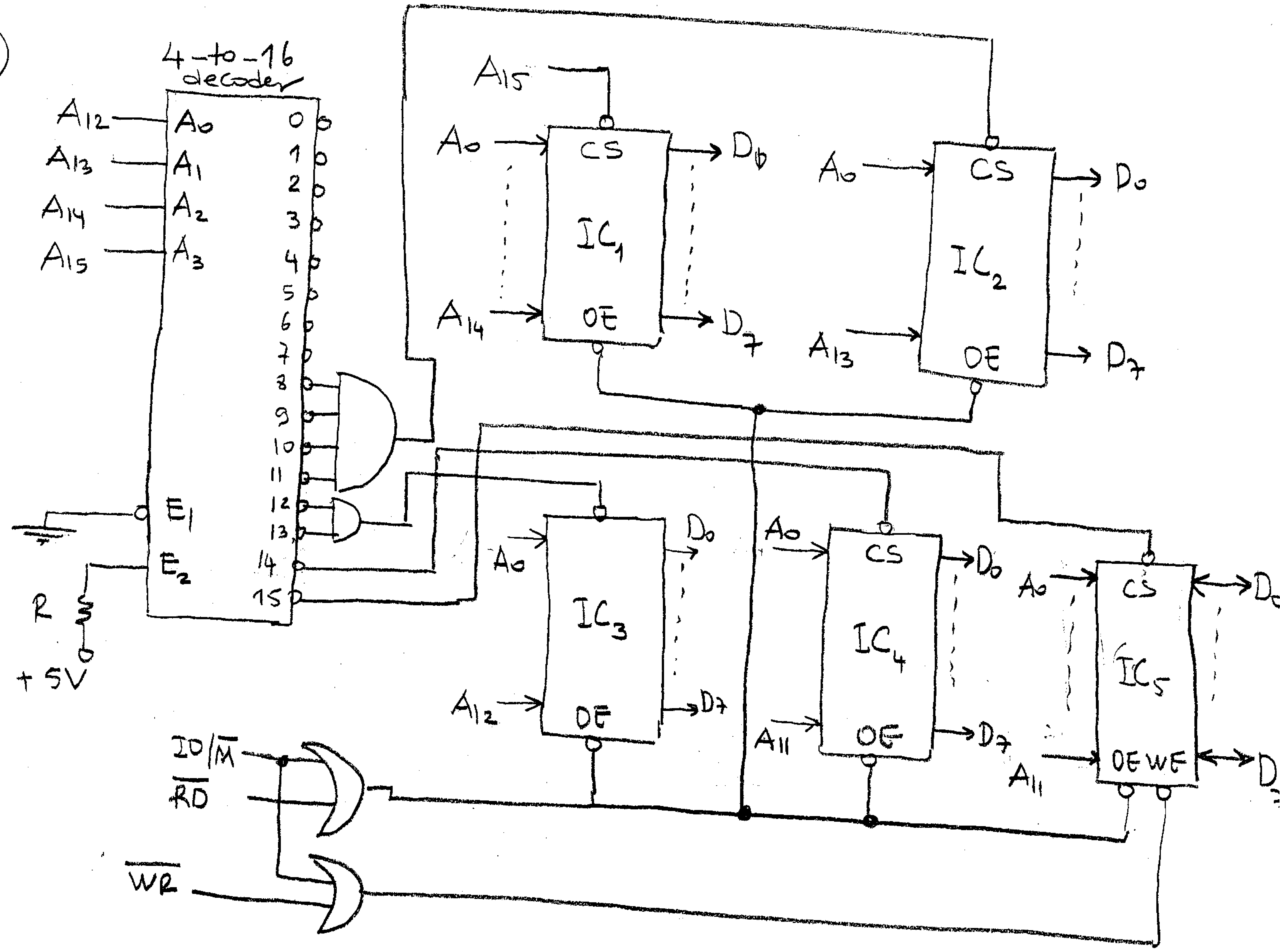
July 21, 2009

#1)



IC #	Type (RAM or ROM)	Capacity (KB)	Selected Address range
1	?	?	?
2	?	?	?
3	?	?	?
4	?	?	?
5	?	?	?

Fill in the above table according to the memory decoder circuitry given in the above figure

→ see back

#2) Realize a decoder circuitry that uses a PROM, which has one active high and one active low enables. This decoder circuitry places the memory IC's given in question 1 into the same address ranges. The capacity of the PROM should be the possible minimum capacity. Show connection of PROM decoder and programming of the PROM together.

#3)

Cancelled !!!

I/O Device number	Selected Address Range
0	FF00h - FF07h
1	FF08h - FF0Fh
2	FF10h - FF17h
3	FF18h - FF1Fh
4	FF20h - FF27h
5	FF28h - FF2Fh
6	FF30h - FF37h
7	FF38h - FF3Fh

Realize a I/O decoder circuitry where the above I/O devices are selected in the corresponding address ranges. Assume that only data can be read from those I/O devices. Use one '138 (3-to-8) decoder and logic gates if necessary.

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#1) From the decoder circuitry given in question-1, the following binary memory map can be written.

selection bits

	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0	Hex
IC_1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	= 0000h
	...																...
	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	= 7FFFh
IC_2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	= 8000h
	...																...
	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	= BFFFh
IC_3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	= C000h
	...																...
	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	= DFFFh
IC_4	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	= E000h
	...																...
	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	= EFFFh
IC_5	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	= F000h
	...																...
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	= FFFFh

IC_1 : 15-bit addr input $\longrightarrow 2^{15} = 2^5 2^{10} = 32$ KB

IC_2 : 14-bit " " $\longrightarrow 2^{14} = 2^4 2^{10} = 16$ KB

IC_3 : 13-bit " " $\longrightarrow 2^{13} = 2^3 2^{10} = 8$ KB

IC_4 : 12-bit " " $\longrightarrow 2^{12} = 2^2 2^{10} = 4$ KB

IC_5 : 12-bit " " $\longrightarrow 2^{12} = 2^2 2^{10} = 4$ KB

Total 64 KB

$IC_1 - IC_4$ only have $\overline{OE}$ strobe input $\longrightarrow$ they are ROM memory

IC_5 has both $\overline{OE}$ and $\overline{WE}$ strobe inputs $\longrightarrow$ It is RAM memory.

As a result

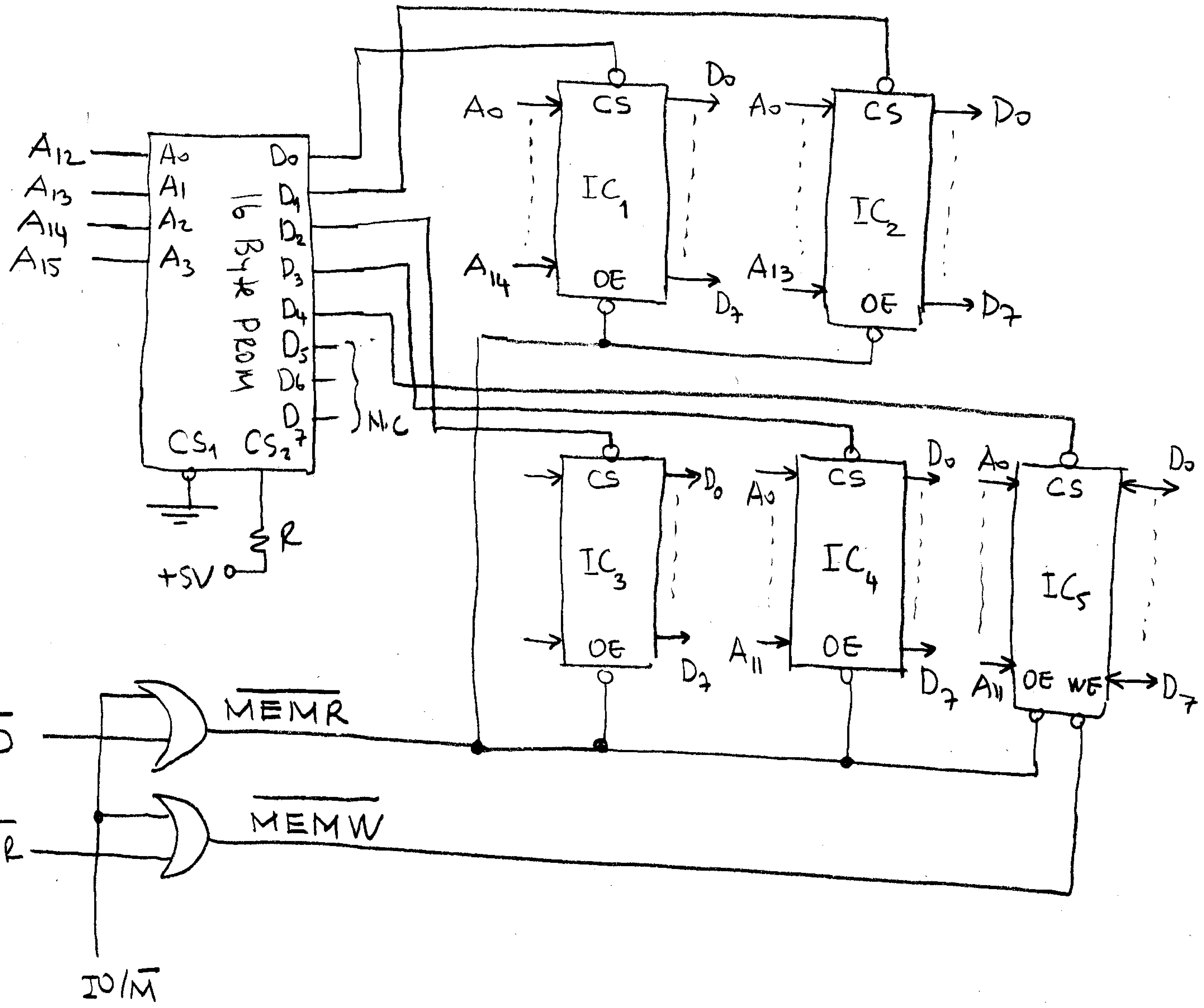
IC #	Type (ROM or RAM)	Capacity (KB)	Selected Address Range
1	ROM	32	0000h – 7FFFh
2	ROM	16	8000h – BFFFh
3	ROM	8	C000h – DFFFh
4	ROM	4	E000h – EFFFh
5	RAM	4	F000h – FFFFh

#2) The minimum capacity of the PROM is $2^4 = 16$ Byte.

The programming table of the PROM

	INPUTS				OUTPUTS								
	A_{15}	A_{14}	A_{13}	A_{12}									
	A_3	A_2	A_1	A_0	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0	
the same → 8 Bytes	0	0	0	0	1	1	1	1	1	1	1	0	the same ← for IC_1
	0	0	0	1	1	1	1	1	1	1	1	0	
	⋮	⋮	⋮	⋮				⋮					
	0	1	1	1	1	1	1	1	1	1	1	0	
4 Bytes	1	0	0	0	1	1	1	1	1	1	0	1	the same ← for IC_2
	1	0	0	1				⋮					
	1	0	1	0									
	1	0	1	1	1	1	1	1	1	1	0	1	
2 Bytes	1	1	0	0	1	1	1	1	1	0	1	1	← for IC_3
	1	1	0	1	1	1	1	1	1	0	1	1	
1 Byte	1	1	1	0	1	1	1	1	0	1	1	1	← for IC_4
1 Byte	1	1	1	1	1	1	1	0	1	1	1	1	← for IC_5
+ 16 Bytes													

All locations are used


A12
A13
A14
A15
A0
A1
A2
A3
16 Byte PROM
D0
D1
D2
D3
D4
D5
D6
D7
N.C
CS1
CS2
R
+5V
CS
IC1
OE
IC2
IC3
IC4
IC5
WE
A0
A14
A13
A11
D0
D7
RD
WR
MEMR
MEMW
IO/M