

ANSWER 1) [15 points]

	Operation	RESULTS (As 8-bit unsigned interpretation)			Status Flags
		Binary	Decimal	Hexadecimal	
a)	10011110 + 10110101	1 01010011	83	53	O=1 , C=1
b)	11100100 And 11111010	11100000	224	E0	N=1
c)	Left shift 3 times 01110011	011 10011000	152	98	N=1 , C=1

ANSWER 2) [45 points]

2a) [5 points]

- Because Data Bus is 16 bits, two 2K x 8 bit memory chips should be used together as a data bus group.
- 6K x 16 bit / 2K x 8 bit = 3 groups x 2 chips per group = **6 memory chips** should be used.
- There should be 3 memory groups, each group has 2 memory chips.

2b) [5 points]

- Each 2K x 8 bit memory chip requires 11 address lines for location selection within chip. ($2K = 2^1 \cdot 2^{10} = 2^{11}$)
- For 3 groups of memory chip selections, we need an Address Decoder (2-to-4 type).
- Address Decoder requires two inputs (2 address lines).
- Total minimum number of address lines in Address Bus = **11 + 2 = 13 lines.**

2c) [15 points]

Smallest Addresses :

Group	Chip	Cap	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	HEXADECIMAL
1	M1	2Kx8	0	0	0	0	0	0	0	0	0	0	0	0	0	0000
	M2	2Kx8	0	0	0	0	0	0	0	0	0	0	0	0	0	0000
2	M3	2Kx8	0	1	0	0	0	0	0	0	0	0	0	0	0	0800
	M4	2Kx8	0	1	0	0	0	0	0	0	0	0	0	0	0	0800
3	M5	2Kx8	1	0	0	0	0	0	0	0	0	0	0	0	0	1000
	M6	2Kx8	1	0	0	0	0	0	0	0	0	0	0	0	0	1000

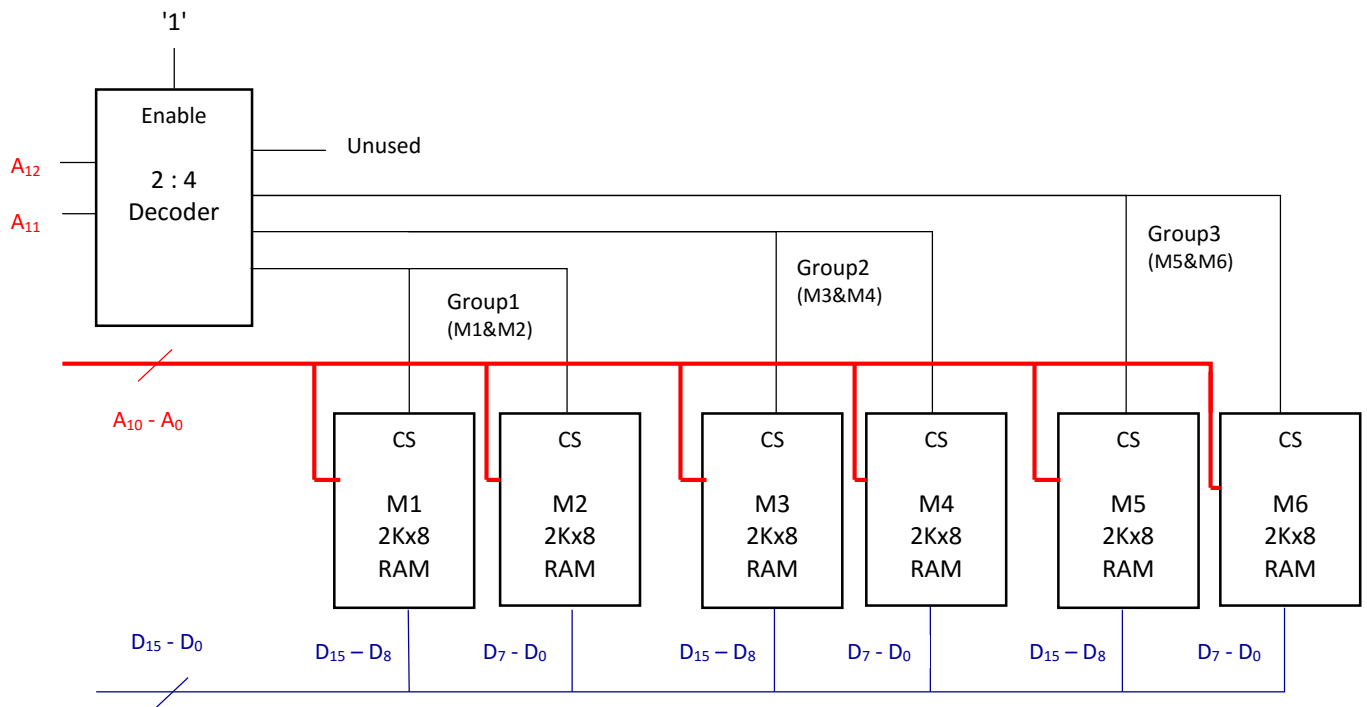
Biggest Addresses :

Group	Chip	Cap	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	HEXADECIMAL
1	M1	2Kx8	0	0	1	1	1	1	1	1	1	1	1	1	1	07FF
	M2	2Kx8	0	0	1	1	1	1	1	1	1	1	1	1	1	07FF
2	M3	2Kx8	0	1	1	1	1	1	1	1	1	1	1	1	1	0FFF
	M4	2Kx8	0	1	1	1	1	1	1	1	1	1	1	1	1	0FFF
3	M5	2Kx8	1	0	1	1	1	1	1	1	1	1	1	1	1	17FF
	M6	2Kx8	1	0	1	1	1	1	1	1	1	1	1	1	1	17FF

HEXADECIMAL MEMORY MAP :

Group	Chip Name	Memory Chip Type	Smallest Address	Biggest Address	Explanation
1	M1	2 K x 8 bit RAM	0000	07FF	M1 & M2 have same addresses
	M2	2 K x 8 bit RAM	0000	07FF	
2	M3	2 K x 8 bit RAM	0800	0FFF	M3 & M4 have same addresses
	M4	2 K x 8 bit RAM	0800	0FFF	
3	M5	2 K x 8 bit RAM	1000	17FF	M5 & M6 have same addresses
	M6	2 K x 8 bit RAM	1000	17FF	
EMPTY (unused 2K locations)			1800	1FFF	EMPTY

2d) [20 points]



ANSWER 3) [10 points]

INSTRUCTION	ADDRESSING METHOD NAME
1. LDA C, <\$2E00>	Direct
2. STA 200, \$B000	Memory Immediate Write
3. LDA C, <SK+3>-6	Decrement Index
4. INC A	Register
5. LDA A, <CD+SK+4>	Register Relative Index
6. MOV C, A	Register
7. LDA CD, \$4FFF	Immediate
8. LDA A, <CD>	Indirect
9. CLR B	Register
10. LDA B, <SK+7>	Indexed

ANSWER 4) [30 points]

<pre> MIN EQU 35 MAX EQU 75 SIZE EQU 15 ARRAY RMB SIZE ORG ARRAY DAT 61, 21, 41, 31, 11, 81, 71, 91, 22, 51, 62, 32, 72, 12, 52 FLTARRAY RMB SIZE ORG FLTARRAY DAT 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 START LDA SK, 0 ;SK is used as index on ARRAY, also as loop counter LDA CD, FLTARRAY ;CD is used as indirect index on FLTARRAY DONGU LDA A, <SK+ARRAY> ;Get next data from ARRAY INC SK ;Increment ARRAY index </pre>	<pre> CMP A, MIN ;Compare data to minimum BLT DEVAM ;If less than MIN, go to label CMP A, MAX ;Compare data to maximum BGT DEVAM ;If greater than MAX, go to label *Data is within MIN and MAX STA A, <CD> ;Store data to FLTARRAY INC CD ;Increment indirect index DEVAM CMP SK, SIZE ;Check for the loop limit BLT DONGU ;If less than SIZE, go to loop INT ;Stop </pre>
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