Homework Problem Set #3 Solution

Q1. (6 point)

1)

Since the memory device has 11 address lines, it contains 2**K**=2^{11} of addressable memory. And the capacity is 2K * 16 bits = 2^{15}

Correct both: 1, Only one is correct: 0.5, both incorrect or no answer: 0

2)

$2^7 * 2 = 256$ devices. Page selection bits are 7.

Correct both: 1, Only one is correct: 0.5, both incorrect or no answer: 0

3)

All correct: 3: upto two mismatches: 2 . More than 2 wrong answer: 1, no anser:0

Page	Starting Address	Ending Address
1	00800	00FFF
50	19000	197FF
100	32000	327FF

4)

Because there is **only one ~WE** signal, which can control only one data at a time, and it is a word.(Or can say: since the device has 16 bits of data line, no signal to choose only half).

Correct: 1

Incorrect: 0.5 (If there is no mention about "only one ~WE signal", then consider it is incorrect)

No answer: 0

Q2. (7 points)

1)

Correct: 2, incorrect: 1 no answer: 0

10 (page number)	17(offset)	2 (byte)

2)

With 1024 pages, and 4 chips per page, we would need 4096 = 2^{12} chips to completely fill the memory space.

Correct: 2, incorrect: 1 no answer: 0

3)

All correct: 3: upto two mismatches: 2 . More than 2 wrong answer: 1, no anser:0

Page Number(decimal)	Starting address	Ending address
15	**00780000**	**007FFFFF**
387	**C180000**	**C1FFFFF**
1020	**1FE00000**	**1FE7FFFF**

Q3. **(4 point) Each sub question is 1 point., Incorrect: -0.5, no answer: 0**

1)

~CE * ~OE * WE0 * WE1 * WE2 * WE3
Or, ~CE * ~OE
In other words, we must select the page and turn on the 4 chip enables, then we must be sure not to enable the outputs and finally, we have to write the 4 bytes that comprise the long-word.

2)
Since this is big endian format, byte address 0 aligns with D31-D24 and byte address 1 is aligned with D16-D23. Therefore, the write operation will use only ~WE2.
WRITE = ~CE * OE * WE0* WE1 *~ WE2 * WE3
Or, WRITE = ~CE * ~WE2

3)
WRITE = ~CE * OE * WE3 * WE2 * ~WE1 * ~WE0
Or WRITE = ~CE * ~WE1 * ~WE0

4)
Since this is a read operation we must be sure not to activate any of the write lines and just activate the output enable line.
READ = ~CE * ~OE * WE0 * WE1 * WE2 * WE3
Or READ = ~CE * ~OE

Everything is correct except inverting all gates, then -1.

Q4.

1) Suppose you want to write a data 1 0 1 to the word 3 (address 3). Give the correct values of S1, S0, Bit2, Bit1, Bit0, ~WE, reset, for this task, and test it with the circuit.

RESET	S1	S0	Bit2	Bit1	Bit0	~WE
0	1	1	1	0	1	1

Correct: 1.5

Incorrect: 0.5

2) Suppose you want to read a data from the address 1 . Give the correct values of S1, S0, Bit2, Bit1, Bit0, ~WE, reset, for this task.

RESET	S1	S0	Bit2	Bit1	Bit0	~WE
0	0	1	x	x	x	0

Correct: 1.5

Incorrect: 0.5

3) **Design the same circuit with built-in RAM circuit and submit the file.**

A sample file is attached

Correct: 2

Incorrect: 1 (Mismatch of address bits or data bits)

No circuit: 0

Q5: 3pts = 2 pts for the answer (**Correct value: 2, incorrect:1, no answer:0**), 1 pts for the source and listing files(if two files attached:1. One file missing: -0.5)

Create a source file and analyze the results. Submit the listfile and answer the question after the code segments. For simplicity, name your source file as HW3.X68. Then your listfile will be named as HW3.L68.

Warning: Do not copy and paste the code segments. It might cause some errors which you might spend whole day to find out.

QUESTION: What is the WORD VALUE (not byte, or longword) of the data in memory location $4000 when the program is just about to loop back to the beginning and start over again? Please describe how you got the answer as well. (For example, you can describe how you analyzed the code segments, or how you traced the code segments with debug tools)

The answer is **4515**.