SOFT400127: Computer Organization & Architecture 2022-Fall

Homework-**4** Solutions

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Honor Code: I promise that I finished the homework solutions on my own without copying other people's work.

1.

SRAM	**DRAM**
Power needed to preserve data	
use transistors to store information.	use capacitors store information.
no refreshing is required. (No capacitors)	capacitors need to be refreshed periodically to store data for a long time.
faster	slower access speeds.
no refreshing unit, smaller memory unit	need refreshing unit, bigger memory unit.
more expensive	cheaper
low-density devices	high-density devices
In this bits are stored in voltage form.	In this bits are stored in the form of electric energy.
used in cache memories	used in main memories
less power	more power

2.

Idea: Use memory hierarchy between main memory and cache ——multi-level caches. Hardware Technology:

- Enhanced DRAM: Contains small SRAM as well SRAM holds last line read.
- Cache DRAM: Larger SRAM component and used as cache or serial buffer.
- Synchronous DRAM (SDRAM): Access is synchronized with an external clock, so CPU knows when data will be ready. Also, data can be loaded with burst mode. As a result, CPU does not have to wait but can do something else.
  - DDR SDRAM: Double-data-rate SDRAM can send data twice instead once per clock cycle using both rising edge and falling edge.

3.

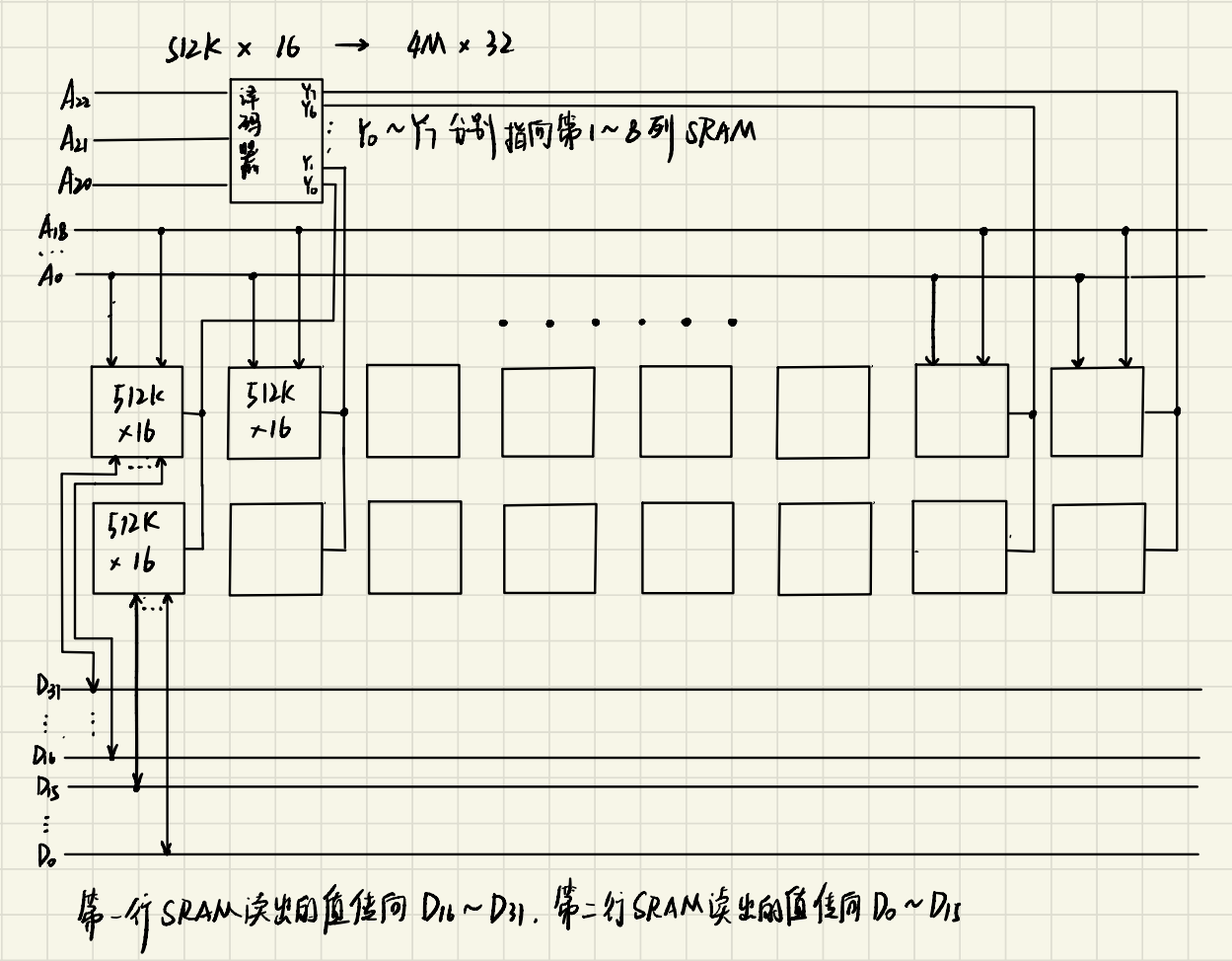
3.1

Answer: $2^{22} \times \dfrac{32 \text{ bits}}{8 \text{ bits per byte}} = 4 \text{ M} \times 4 \text{ B} = \mathbf{16\ MB}$

3.2

Answer: $\dfrac{16 \text{ MB}}{512 \times 2^{10} \times 16/8 \text{ bytes}} = 16$ pieces.

3.3



4.

Step 1&2: Memory Capacity and Chip Section

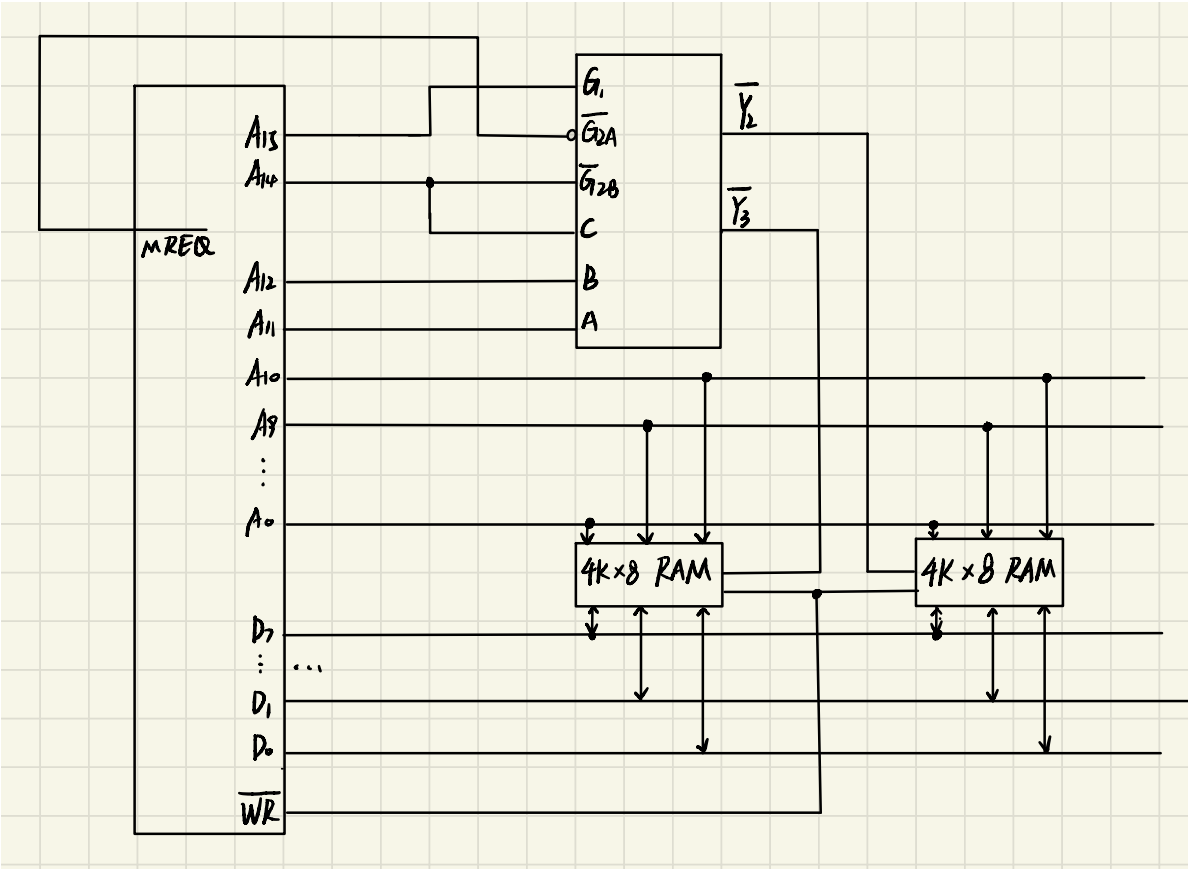
$\frac{8 \text{ KB}}{4 \text{ K} \times 8/8 \text{ B}} = 2$, so choose two $4 \text{ K} \times 8$ chips.

Step 3: Allocate CPU address lines

$A_0 - A_{11}$ to choose word inside a chip. Left high bits and MREQ are used for chip selection.

	Input	A15	A14-A12			A11	·····	A0
Chip1	a000	1	0	1	0	0	·····	0
	aFFF	1	0	1	0	1	·····	1
Chip2	b000	1	0	1	1	0	·····	0
	bFFF	1	0	1	1	1	·····	1

Step 4: Draw the picture



Other things

- LaTeX code refer to these things and was complied on texlive2020.
  - UCB-CS70's given homework template.
  - A free website useful to edit LaTeX formula code.
- refer to Professor Li.'s PPT.

Thanks for your correcting and grading :).