

SOLUTIONS

45 minutes

1. The following memories are specified by the number of words times the number of bits per word. How many address lines and input-output data lines are needed for the following cases? a) $128K \times 32$ b) 1024×64 . (10pts)

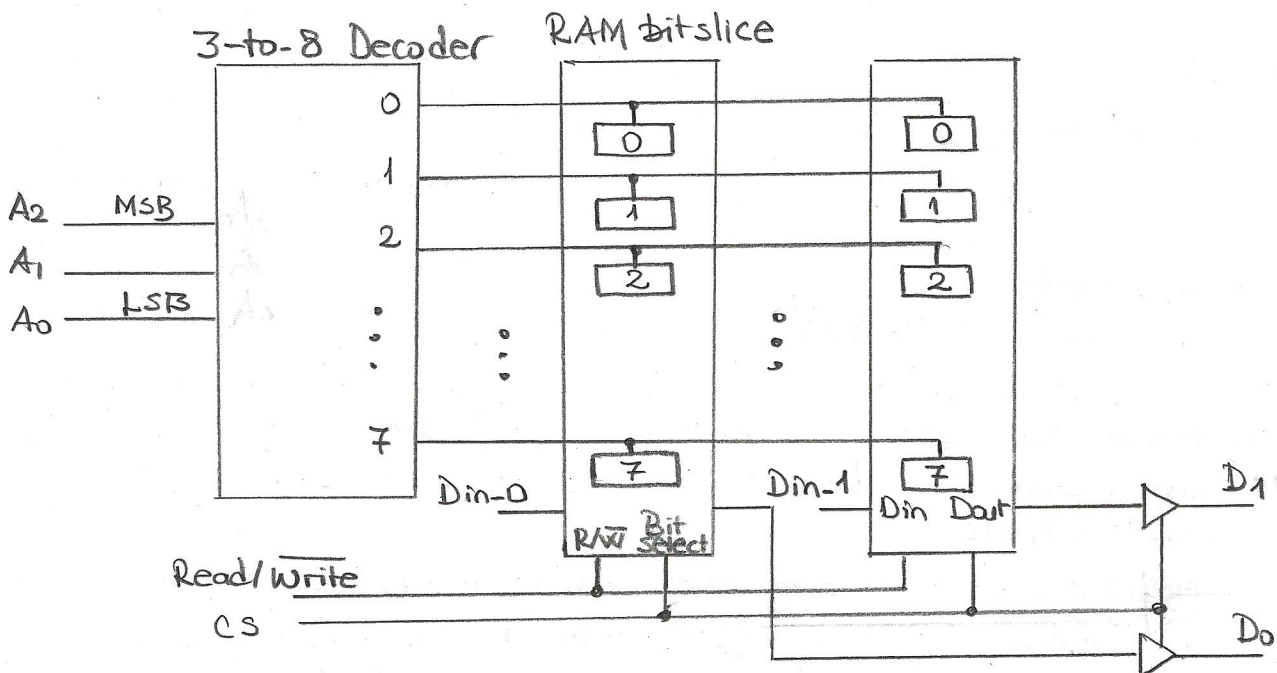
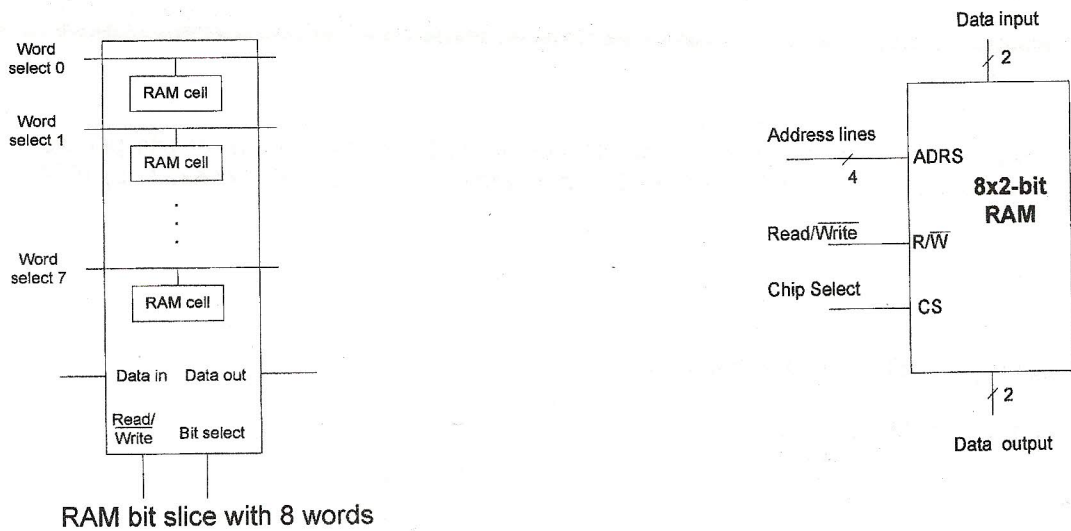
a. $2^7 \cdot 2^{10} \times 32$
17 address lines
32 bits/word

b. $2^{10} \times 64$
10 address lines
64 bits/word

2. Explain the followings briefly: (04x10=40pts)

- a. Random Access Memory: In RAM, transferring information to or from any location takes same time regardless of the location.
- b. Static Memory:
Static Memory is constructed from latches to store the binary information.
- c. Dynamic Memory:
Dynamic memory stores the binary information in the form of charges on capacitor.
- d. Volatile Memory:
Volatile memory lose stored information when the power is turned off.
- e. Opcode: The opcode (operation code) is a group of bits in the instruction that specifies an operation, such as add, subtract, etc.
- f. Program Counter: It is register and it provides the address in memory of the instruction to be executed.
- g. Instruction Decoder: Instruction decoder provides all of the control words for the datapath based on the contents of the fields of the instruction.
- h. PC Relative Addressing Method: Instruction word specifies an address offset. New contents of PC register is formed by adding the current PC contents and the address offset.
- i. Mnemonic:
Shorthand name for opcode or symbolic representation for the opcode.
- j. Assembler:
Assembler is a program that converts the symbolic representation of the instruction to binary representation.

3. Using the RAM bit slice with 8 words, 3-to-8 decoder and two tristate buffers, construct 8 words by 2-bit RAM. (30pts)



4. In coincident selection structure, in order to make row and column decoder size equal, square root of total number of bits in RAM is calculated. The exponent of 2 gives the number of selection lines (N_{ROW}) in the row decoder. The difference between the number of address lines in the RAM and N_{ROW} gives the number of selection lines in the column decoder (N_{COL}).

- a. What is the row and column decoder size of 8K words by 8-bit RAM? (16pts) $1K=2^{10}$

$$\sqrt{2^3 \times 2^{10} \times 2^3} = 2^8$$

8-to-256 Row Decoder

5-to-32 Column Decoder

- b. Find the decoder size if the same RAM (8Kx8) is constructed with single decoder. (04pts)

$$2^3 \cdot 2^{10} = 8K$$

13 address Lines

13-to- 2^{13}

or

13-to-8192 Decoder