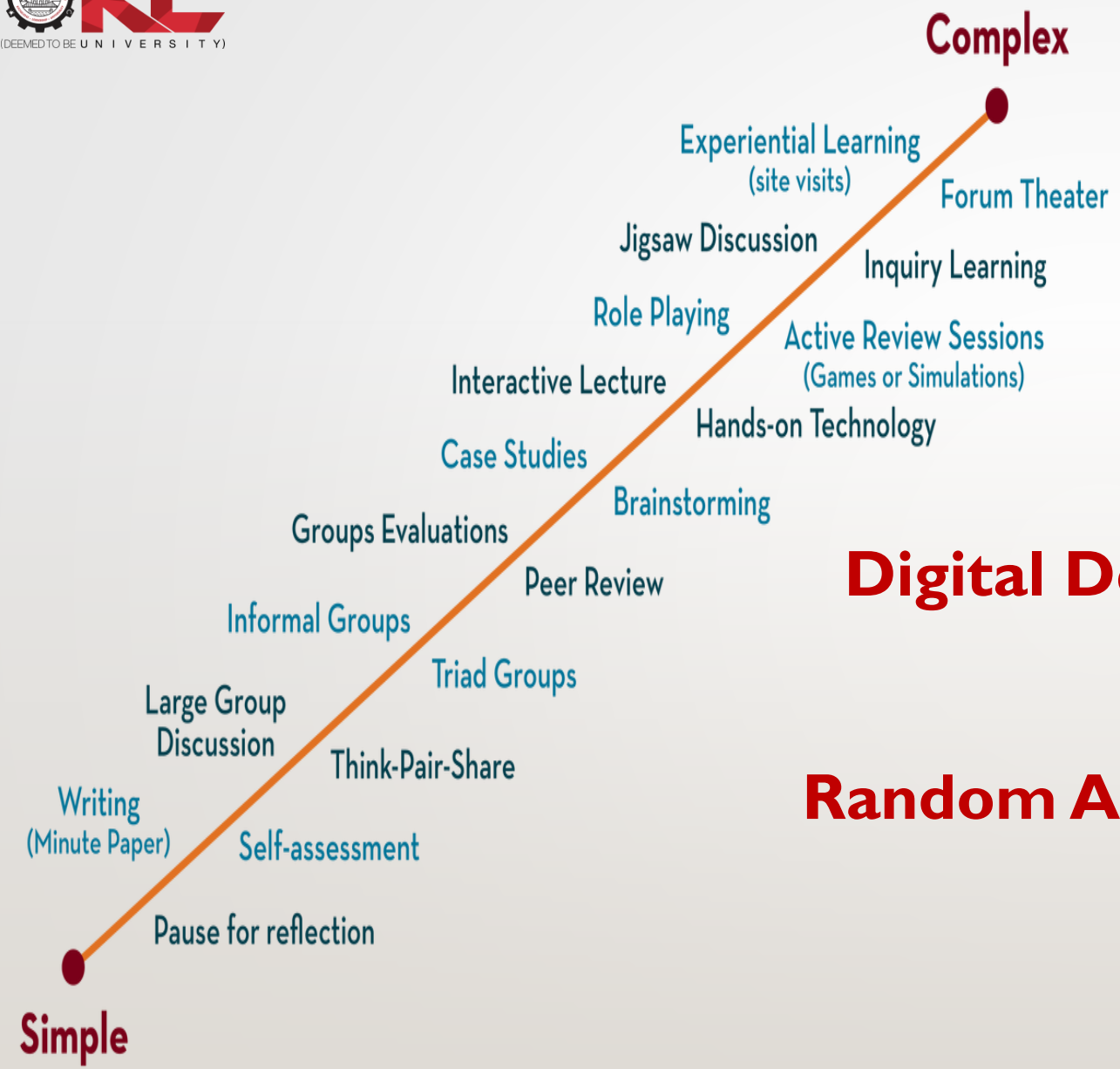


Department of BES-II

Digital Design and Computer Architecture
23EC1202

Topic:

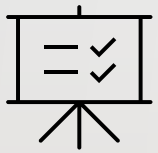
Random Access Memory (RAM) and Memory Decoding

Session No: 20 & 21

AIM OF THE SESSION

To familiarize students with the basic concept of Random Access Memory (RAM) and Memory Decoding

INSTRUCTIONAL OBJECTIVES



This Session is designed to:

1. Demonstrate the importance of RAM and Memory decoding
2. Describe the operation of READ and WRITE cycles in RAM
3. List out the how digital systems manage and access memory resources
4. Describe the importance of memory decoding

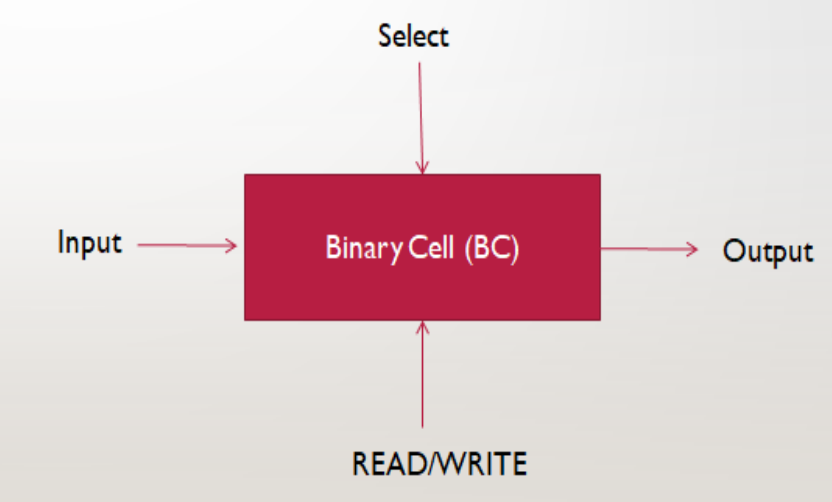
LEARNING OUTCOMES

At the end of this session, you should be able to:

1. Define SRAM and DRAM
2. Describe the read and write operation of Random Access Memory
3. Summarize the capacity of Random Access Memory from its inputs and outputs

Memory Cell

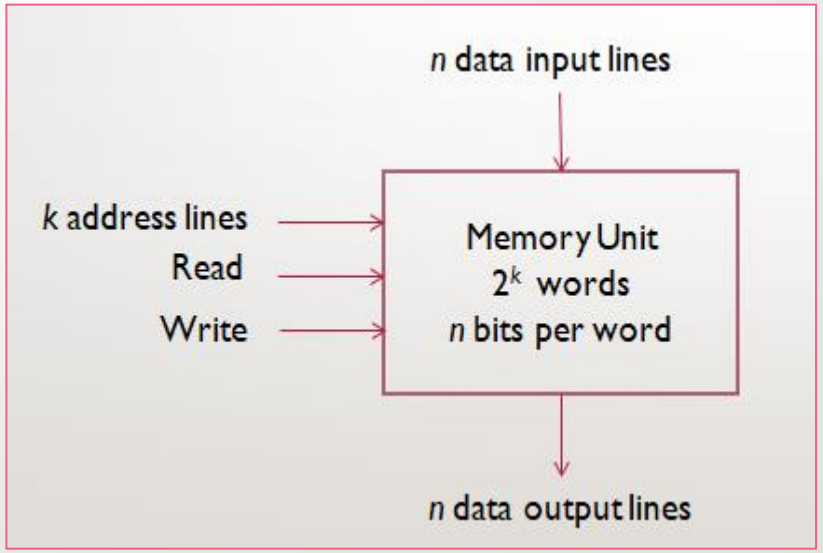
- The equivalent logic of a binary cell that stores 1-bit of information is shown below, which performs operations based on read/write.



Block Diagram of Memory cell

Random Access Memory (RAM) Block Diagram

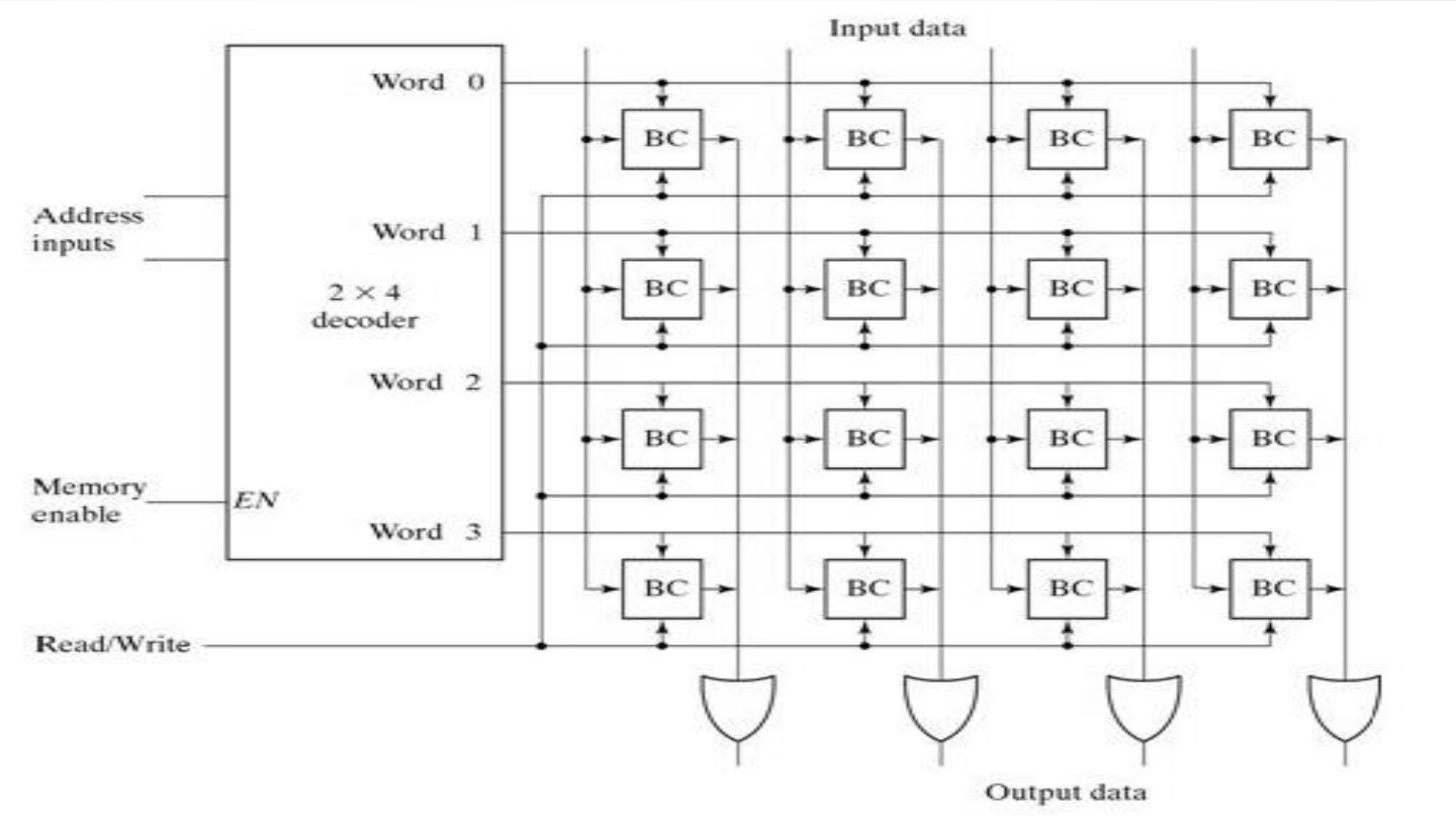
- RAM is a computer's volatile memory which stores data temporarily. It is also known as primary or temporary memory.
- RAM stores the data that is actively being used during the execution of a program or instructions.
- A memory unit stores binary information in groups of bits called "word". 1 byte = 8 bits ;1 word = 2 bytes = 16 bits
- The communication between a memory and its environment is achieved through data input and output lines, address selection lines and control lines that specify the direction of transfer.



Block Diagram of Random Access Memory (RAM)

Memory decoding

This is a **4x4 memory array** schematic that operates as a **random-access memory (RAM)** system.



Memory decoding

- There is a need for decoding circuits to select the memory word specified by the input address.
- During READ operation, the 4 – bits of selected "word" go through OR gates to the output.
- During WRITE operation, the data available in the input lines are transferred into the binary cells of the selected word.
- A memory with 2^k words of "n" bits per word requires "k" address lines that go in to $K \times 2^k$ decoder.
- **Address Inputs**: Select the row (word) using the decoder.
- **Memory Enable (EN)**: Controls whether the memory is active.
- **Read/Write Signal**: Chooses between reading and writing data.
- **Input Data**: Data to be written into the selected row.
- **Output Data**: Data read from the selected row.

SUMMARY

- RAM is used in computers for the temporary storage of programs and data
- By using the READ and WRITE operations, the contents of the RAM address locations will be read from and written to during the execution of a program by computer
- Memory decoding plays an important role in memory devices like RAM and ROM
- Selects a specific memory location based on address provided by CPU or a control unit

SELF-ASSESSMENT QUESTIONS

1. RAM is a volatile or non-volatile memory ?

(a) Volatile memory
(b) Non-volatile Memory
(c) Both (a) and (b)
(d) (a) or (b)

2. WRITE operation is

(a) input
(b) output
(c) Transfer-in
(d) Transfer-out

SELF-ASSESSMENT QUESTIONS

3. What is memory decoding ?

(a) Selects memory

(b) Selects specific memory location based on address provided by CPU or a control unit

(c) Both (a) and (b)

(d) (a) or (b)

4. Which type of memory is commonly used as cache memory in computer systems?

(a) DRAM

(b) SRAM

(c) Flash Memory

(d) ROM

TERMINAL QUESTIONS

Short answer questions:

1. Describe the importance of memory decoding in digital circuits.

Long answer questions:

1. Draw a 4*4 RAM utilizing memory cells for memory decoding.
2. Construct the generalized block of RAM and specify the importance of various lines of input and output.
3. Construct a memory decoding unit, using a 2:4 decoder.

REFERENCES FOR FURTHER LEARNING OF THE SESSION

Reference Books:

1. Computer System Architecture by M. Moris Mano
2. Fundamentals of Digital Logic with Verilog HDL by Stephen Brown and ZvonkoVranesic

Sites and Web links:

1. https://www.brainkart.com/article/Memory-Decoding_6774/
2. https://www.geeksforgeeks.org/what-is-memory-decoding/

THANK YOU

(DEEMED TO BE UNIVERSITY)

Team – Digital Design & Computer Architecture