EXPERIMENT NO.: 07 **DATE: 12/03/2020**

AIM: To stimulate RAM and ROM using Logisim

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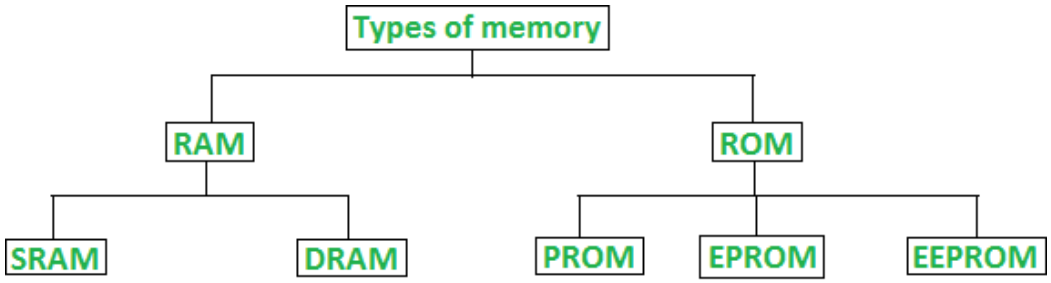
THEORY:

Memory is the most essential element of a computing system because without it computer can't perform simple tasks. Computer memory is of two basic type – Primary memory (RAM and ROM) and Secondary memory (hard drive, CD, etc.). Random Access Memory (RAM) is primary-volatile memory and Read Only Memory (ROM) is primary-non-volatile memory.



Classification of computer memory

Random Access Memory (RAM) –

- It is also called as *read write memory* or the *main memory* or the *primary memory*.
- The programs and data that the CPU requires during execution of a program are stored in this memory.
- It is a volatile memory as the data loses when the power is turned off.
- RAM is further classified into two types- *SRAM (Static Random Access Memory)* and
  DRAM (Dynamic Random Access Memory).

  To be useful, memory cells must be readable and writeable. Within the RAM device, multiplexing and demultiplexing circuitry is used to select memory cells. Typically, a RAM device has a set of address lines A0... An, and for each combination of bits that may be applied to these lines, a set of memory cells are activated. Due to this addressing, RAM devices virtually always have a memory capacity that is a power of two.

  Usually several memory cells share the same address. For example, a 4 bit 'wide' RAM chip has 4 memory cells for each address. Often the width of the memory and that of the microprocessor are different, for a 32 bit microprocessor, eight 4 bit RAM chips would be needed.

  Often more addresses are needed than can be provided by a device. In that case, external multiplexors to the device are used to activate the correct device that is being accessed.

DRAM	SRAM
1. Constructed of tiny capacitors that leak electricity.	1.Constructed of circuits similar to D flip-flops.
2.Requires a recharge every few milliseconds to maintain its data.	2.Holds its contents as long as power is available.
3.Inexpensive.	3.Expensive.
4. Slower than SRAM.	4. Faster than DRAM.
5. Can store many bits per chip.	5. Can not store many bits per chip.
6. Uses less power.	6.Uses more power.
7.Generates less heat.	7.Generates more heat.
8. Used for main memory.	8. Used for cache.

Difference between SRAM and DRAM

Read Only Memory (ROM) –

- Stores crucial information essential to operate the system, like the program essential to boot the computer.
- It is not volatile.
- Always retains its data.
- Used in embedded systems or where the programming needs no change.
- Used in calculators and peripheral devices.
- ROM is further classified into 4 types- *ROM*, *PROM*, *EPROM*, and *EEPROM*.
- Although the relative speed of RAM vs. ROM has varied over time, as of 2007 large RAM chips can be read faster than most ROMs. For this reason (and to allow uniform access), ROM content is sometimes copied to RAM or shadowed before its first use, and subsequently read from RAM.

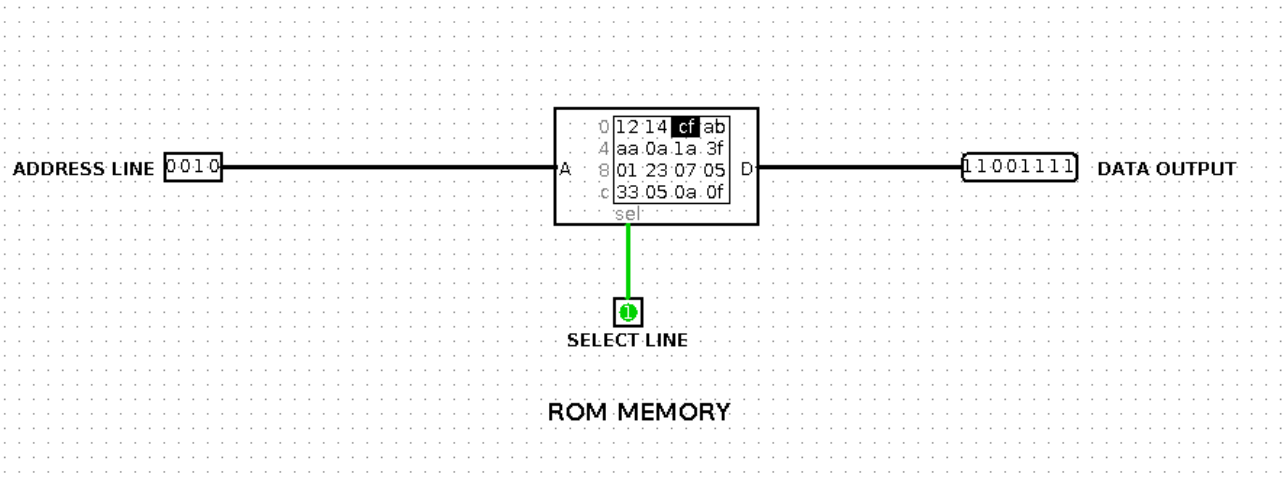
Types of Read Only Memory (ROM) –

1. **PROM (Programmable read-only memory)** – It can be programmed by user. Once programmed, the data and instructions in it cannot be changed.
2. **EPROM (Erasable Programmable read only memory)** – It can be reprogrammed. To erase data from it, expose it to ultra violet light. To reprogram it, erase all the previous data.
3. **EEPROM (Electrically erasable programmable read only memory)** – The data can be erased by applying electric field, no need of ultra violet light. We can erase only portions of the chip.

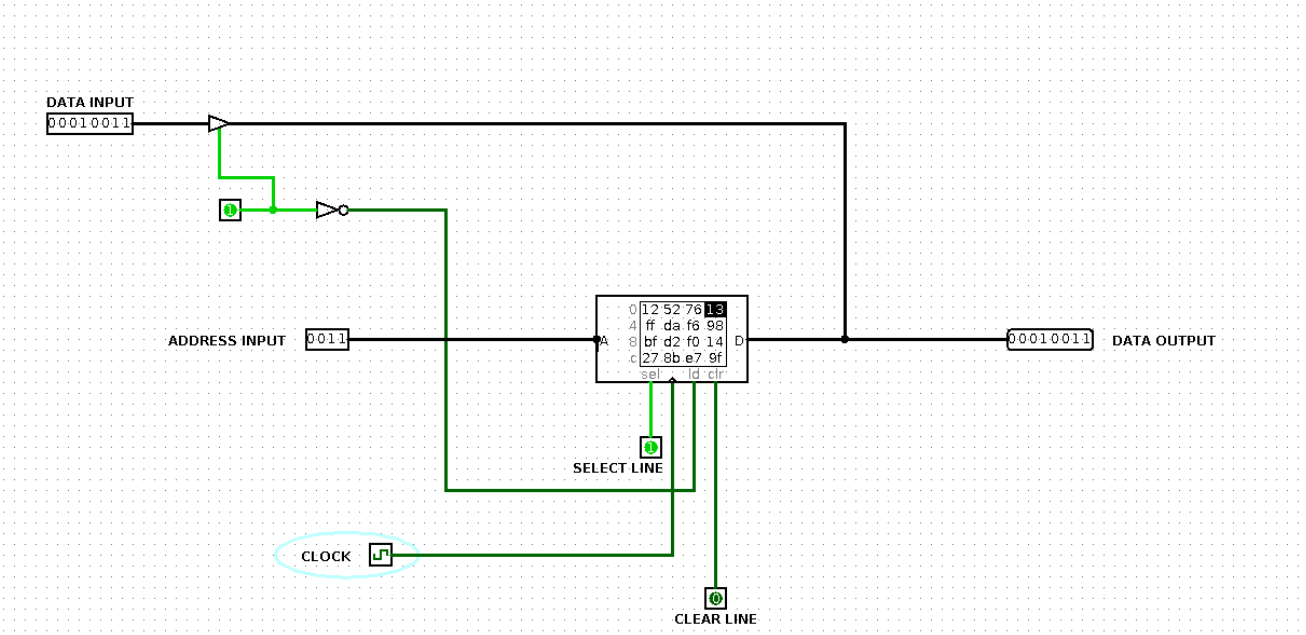
RAM	ROM
1. Temporary Storage.	1. Permanent storage.
2. Store data in MBs.	2. Store data in GBs.
3. Volatile.	3. Non-volatile.
4.Used in normal operations.	4. Used for startup process of computer.
5. Writing data is faster.	5. Writing data is slower.

Difference between RAM and ROM

Simulating Rom using Logisim :-

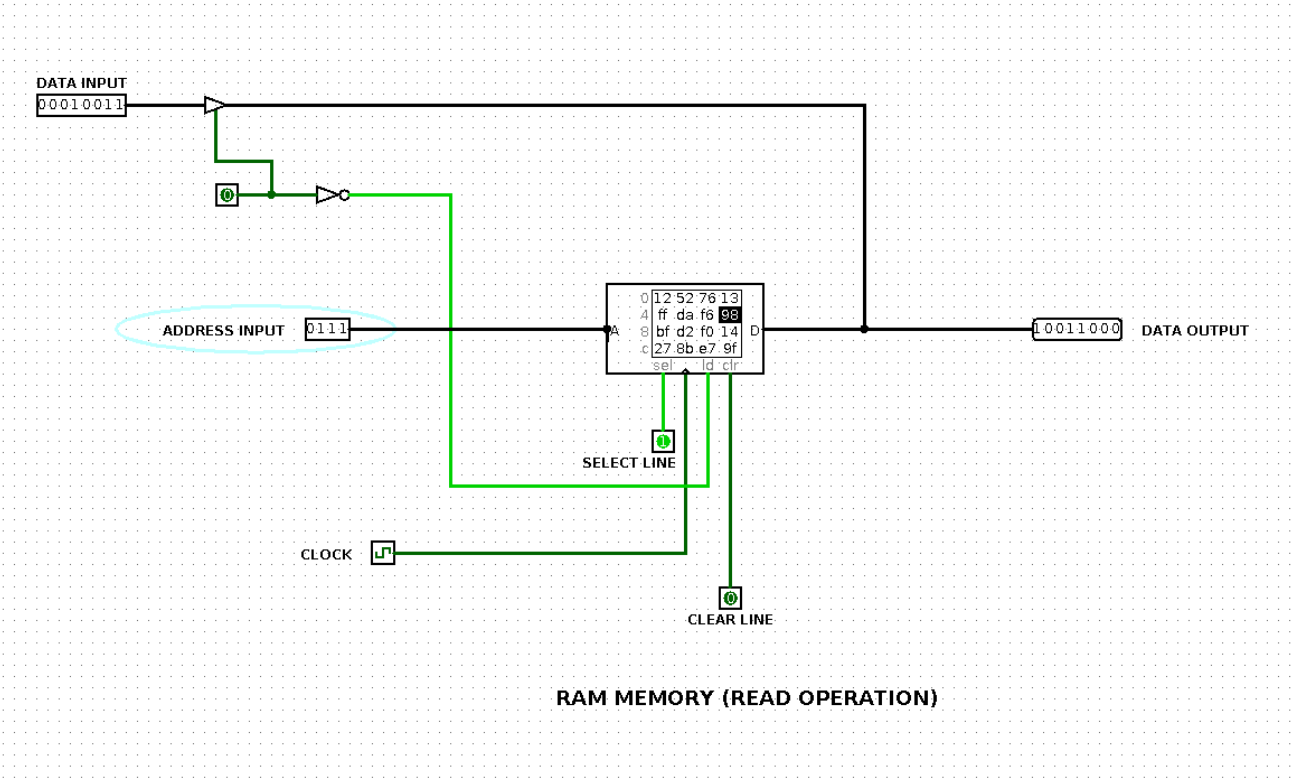


Simulating RAM using Logisim:- (Write Operation)



RAM MEMORY (WRITE OPERATION)

Simulating RAM using Logisim:- (Read Operation)



RAM MEMORY (READ OPERATION)

CONCLUSION:

Hence we have learned to Simulate RAM and ROM using Logisim.