# **Lecture Assignment – 4**

**Name: Abdallah Mahmoud Amin ID:20211062**

**Q1: Compare the differences between how DRAM and SRAM work. What is the use of RAS and CAS in DRAM and are they needed in SRAM? Include the advantages and disadvantages of each type: -**

DRAM (Dynamic Random Access Memory) and SRAM (Static Random Access Memory) are two common types of memory used in computers each with unique architectures of their own.

**DRAM:** is a type of a RAM memory that stores each bit of data in a cell, these memory cells is made up by a tiny capacitor and a transistor, it changes its state from 0 to 1 periodically, it has a problem with the slow leaking of charge from the capacitor, to resolve that issue DRAM requires an external memory refresh.

RAS(row access strobe) & CAS(column access strobe) are two control signals used in DRAM that enable the memory controller to specify the row & column of memory cells to access as RAS is used to select the row that should be accessed, when an access is initiated the address of the row is presented to the DRAM chip, then RAS signal is activated, while CAS is used to determine the column within the selected row where the data should be read or written, so CAS is always activated after RAS but once the column is selected the data can be written to or read from the specific memory cell.

A diagram of a diagram of a diagram

Description automatically generated with medium confidence

**SRAM:** is a form of a semiconductor, used widely in microprocessors and electronic devices as a cache memory, it’s a volatile memory composed of flip flops, it has 4-6 transistors and the flip flops keeps the bits stored until the opposite bit is stored in it, and the data stored in it doesn’t need to be refreshed unlike DRAMs.

Since SRAM doesn’t rely on refreshing cycles like DRAM it doesn’t need separate RAS and CAS signals for accessing data Instead SRAM uses simple address lines for read/write operations.

**A diagram of a circuit

Description automatically generated**

|  |  |  |
| --- | --- | --- |
|  | **Advantages** | **Disadvantages** |
| **DRAM** | * Low costs of manufacturing * greater memory capacities * simple design | * slower access speed * high power consumption * data can be lost in case of power loss |
| **SRAM** | * Low power consumption * Faster access speed * Bigger storage than DRAM | * Low memory capacity * Expensive manufacturing * Complex design |

References ([electronicshub](https://www.electronicshub.org/sram-vs-dram/) , [GFG](https://www.geeksforgeeks.org/difference-between-sram-and-dram/) , [hardwarehell](https://hardwarehell.com/articles/ras_cas.htm))

**Q2. Compare the number of pins set aside for address and data buses in each of the following memory chips. Explain how you derive your answers:**

This notation ("32K x 4" and "32K x 2") represents the organization of the memory chip: The "32K" denotes the memory capacity in kilobits. 32K equals 32 \* 1024 bits. The "x 4" and "x 2" denote the number of data bits that can be accessed per memory access it indicates the width of the memory chips data bus. Now let’s calculate the number of pins set aside for address and data buses for each memory chip:

(Note: x 🡪 number of address pins, y 🡪 number of data pins) **a. 32K x 4 DRAM:**

Memory capacity = 32Kb

Data width = 4 bits per access

For a DRAM the capacity is calculated through the following equation:

**Capacity =** **22\*x\*y**

Thenaddress buses = log2(32 \* 1024) = 15 address lines

**b. 32K x 2 SRAM:**

Memory capacity = 32Kb

Data width = 2 bits per access

For a SRAM the capacity is calculated the following equation:

**Capacity =** **2x\*y**

Address pins = log2(32 \* 1024) = log2(32768) = 15 address pins

**therefore:**

1. **For the 32K x 4 DRAM chip:**

* 15 pins are set aside for the address bus.
* 4 pins are set aside for the data bus.

1. For the 32K x 2 SRAM chip:

* 15 pins are set aside for the address bus.
* 2 pins are set aside for the data bus.