International University of Business Agriculture and Technology

Assignment No-03

Assignment Title: Random Access Memory (RAM)

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Random Access Memory (RAM)

RAM (Random Access Memory) is a type of computer memory that enables the storage and quick retrieval of data that the computer's processor can access. It allows the CPU to read and write data at high speeds, facilitating efficient and rapid data processing. RAM is a volatile memory, meaning it requires a constant power supply to retain its data. When the computer is powered off or restarted, the data stored in RAM is lost. Therefore, it is essential to save any important data to a non-volatile storage device like a hard drive before shutting down. RAM provides fast data access compared to other storage mediums such as hard drives or solid-state drives. It has faster read and write speeds, allowing the processor to retrieve data swiftly, which helps improve overall system performance. RAM capacity refers to the amount of memory available for data storage. It is typically measured in gigabytes (GB) or terabytes (TB). The more RAM a computer has, the more data it can hold in its active state, which can enhance multitasking capabilities and support resource-intensive applications. There are different types and generations of RAM, including DDR3, DDR4, and DDR5. Each generation offers increased data transfer rates and improved efficiency compared to its predecessors. Ram installation probably the most common type of upgrade a PC tech performance. The task consider the study here are:

1. Determining the Amount of RAM in PC

2. Identifying Types of RAM

3. Removing and Installing RAM

4. Exploring RAM Specifications with CPU-Z

1. Determining the Amount of RAM in PC

There are several ways to determine much RAM installed in a PC. First it possible to check the RAM count during the boot process (Some of the newer machines hide in the RAM count, even its enable ibn the BIOS).This tells how much RAM the system BIOS recognize during its check of the system. Second check the amount of RAM that Windows recognizes from within the OS; and third remove the PC case cover and physically examine the Ram sticks install in the motherboard, those slots are arrange in the groups called banks. Depending on computer's design, a bank might include one, two or three slots. When new memory installed, it must fill every slots in a bank to take advantage of whatever the RAM technology has using the banks. For example, if a computer is use triple channel RAM with three slots bank. Must install RAM as a set of three or RAM will not run at its ultimate speed. There are some big differences in RAM slots for each type of motherboard.

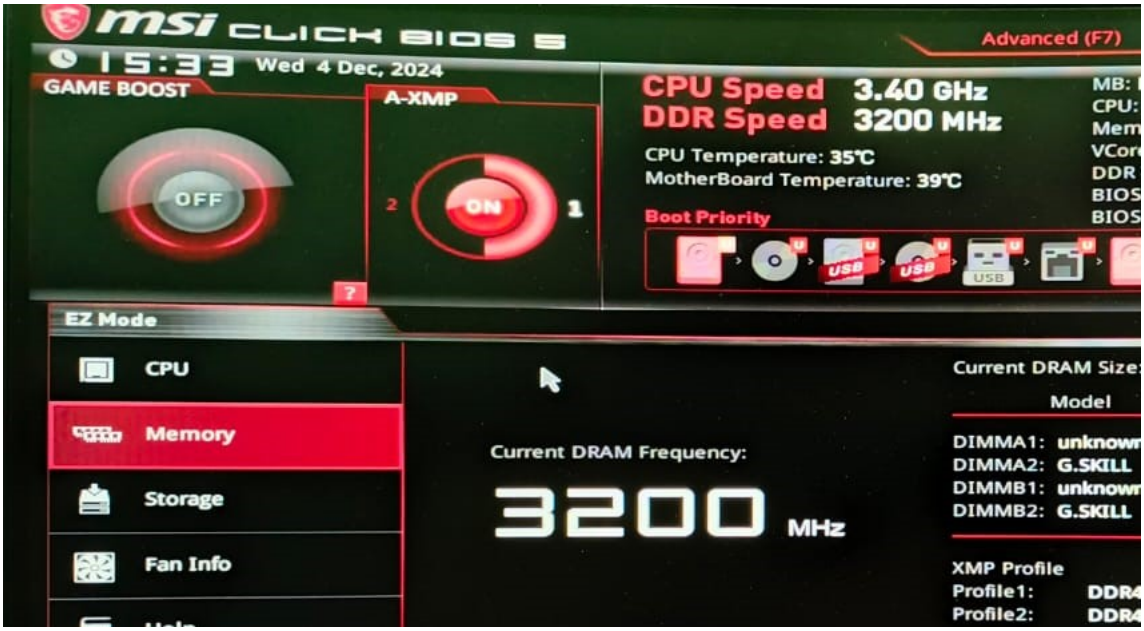

Fig-1.1: RAM Count in BIOS.

Step 1: Turn on PC, and watch the display as the system goes through its startup routine, otherwise known as a power-on self-test (POST). Typically, the RAM count runs near the top-left side of the screen. Figure 1.1 shows an example of a typical RAM count. Most BIOS

programs display the RAM count in kilobytes (KB). To convert this figure to megabytes (MB), divide it by 1024.Many systems run through the startup routine quickly, so the RAM count might appear on the screen for only a few seconds. Press the PAUSE/BREAK key to pause the boot process so that there is the enough time to write down the number accurately. When the boot process to resume, press the ENTER key.

Step 2: Use the following methods to determine the amount of RAM on the system from within any version of Windows.

a. In Windows Vista, open the Start menu, highlight Computer, right-click, and select Properties to see the amount of RAM in system. In Windows 7, right-click on 'My Computer' icon and select 'Properties'. And in Windows 10 or 11, right click on 'This PC' icon from the desktop or from the Windows File Explorer and select 'Properties'. The RAM count is under the System area (see Figure 1.2). It is possible to see other useful information here, like the processor type, Windows edition, the product ID, and more.

b. Notice that Windows 2000 shows the amount of RAM in kilobytes, while Windows XP and Vista show it in gigabytes.

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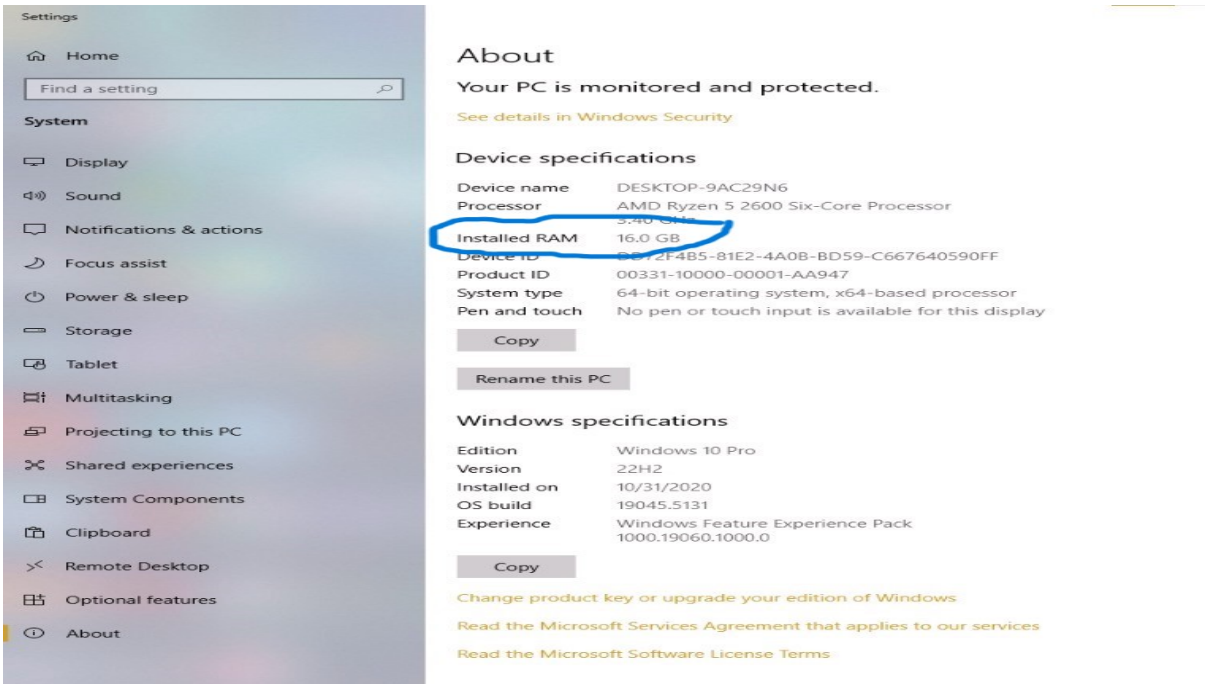

Figure1.2: Viewing the RAM count in Windows 10 pro via Computer

Another way to see the amount of memory installed is to follow this procedure:

- Click Start | Programs (or All Programs) | Accessories | System Tools | System Information.

In the System Summary, look for a value called Total Physical Memory (see Figure 1.3).

- The amount of RAM will be listed in the displayed information

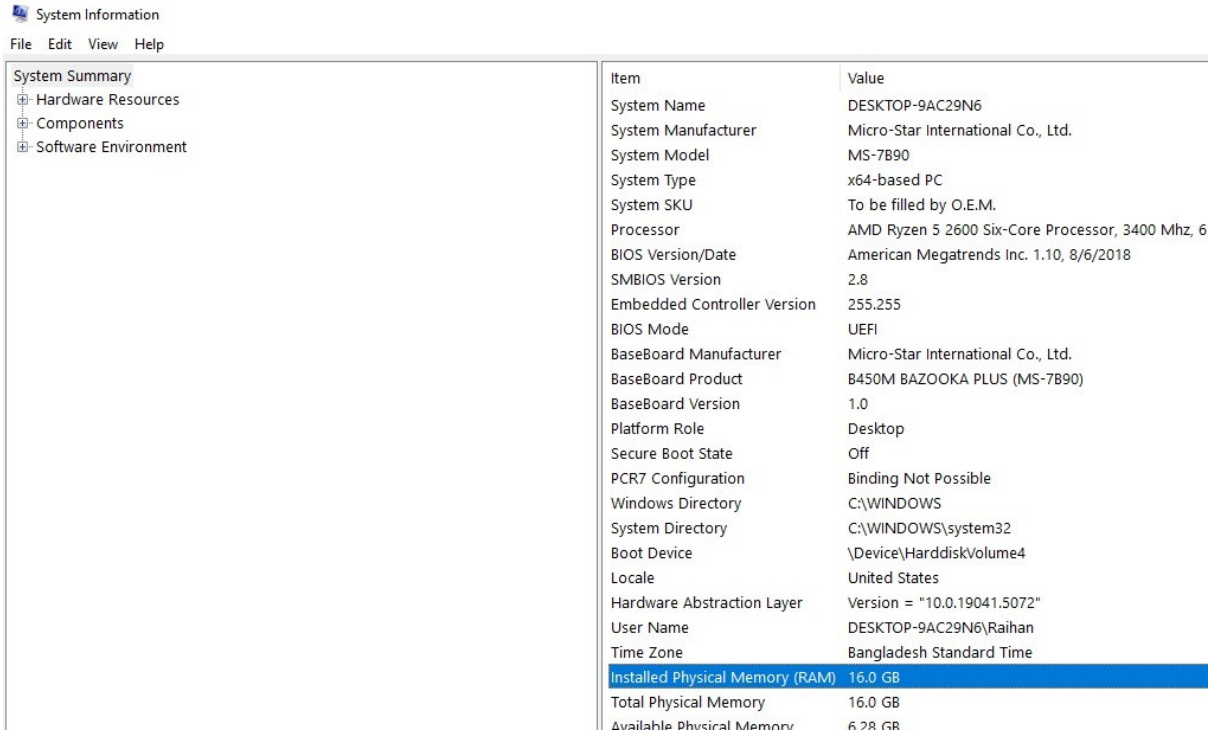

Fig 1.3: The System Information dialog box showing Installed and Total Physical Memory

2. Identifying Types of RAM

RAMs come in several standardized from factors, each compatible with specific types of system. Modern desktop systems use full- sized dual inline memory modules (DDR4 DDIMs &DDR3 DDIMs) of various pin configurations. Laptop computer use scaled down DDR4 & DDR3 version called small outline.

Figure 2.1: My PCs RAM(DDR4 DIMM)

Another way to see the amount of memory installed is to follow this procedure:

Step 1: Typically, as older machines become obsolete and fall into disuse, they are easier to acquire for little or no cost. Many times, this is exactly the type of PC you have available to disassemble, so there is a good chance that it will use older memory (RAM) as well. If you are using an older, non-production machine for your exploration, there's a good chance the motherboard supports one of these older types of RAM packages (included here for your information):

- **168-pin DIMMs** These are about five inches long and have 84 physical pins (edge Connectors) on each side, and all 168 connectors are used. The board has two notches on the bottom: one near the center, and the other near an end (see Figure 2.2).

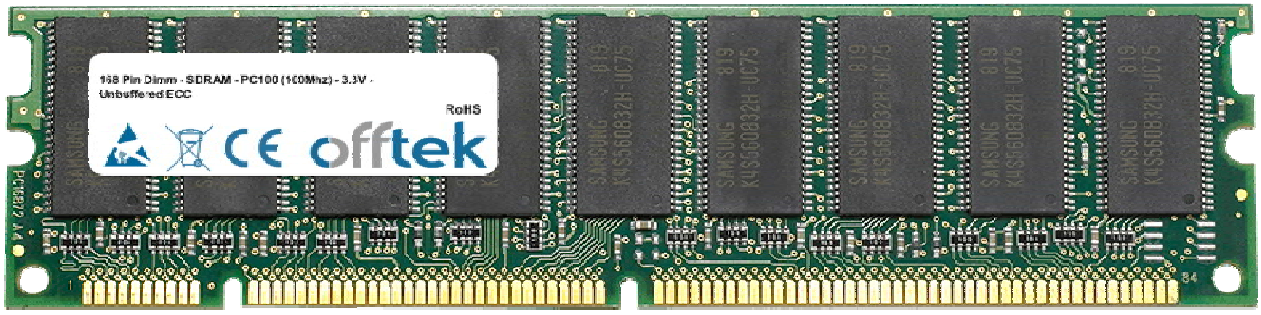

Figure 2.2: A 168-pin DIMM

- **184-pin RIMMs:** Ram bus Dynamic RAM (RDRAM) is the type of RAM you might find if you are working with an old Intel Pentium III or Pentium 4 motherboard. A stick of RDRAM is called a RIMM. RIMM is actually trademarked as a word; it's not an acronym like DIMM, despite what many people assume (see Figure 4.7).

Figure 2.3:A 184-pin RIMM

If you are using a typical desktop system and it is relatively new (less than two years old), the Motherboard will most likely support one of the following three types of RAM packages:

- **184-pin DDR DIMMs:** DDR RAM sticks are about five inches long and look a lot like 168-pinDIMMs, but with only one notch and more connectors. These are known as double data rate(DDR) memory. The notches are different from 168-pin DIMMs, so these RAM types are not interchangeable (see Figure 4.8).

Figure 2.3: A 184-pin DDR DIMM

240-pin DDR2 DIMMs: DDR2 RAM sticks are physically the same size as the 184-pin DDRDIMMs, but the guide notch is in a different location and there are obviously more Connectors. DDR2 uses a 240-pin DIMM (see Figure 4.9) that's not compatible with DDRRAM slots. DDR2 is expected to perform better than DDR due to lower voltage requirements, clock doubling on the chips' input/output circuits, and special prefect buffers.

Figure 2.4: A 240-pin DDR2 DIMM

- **240-pin DDR3 DIMMs:** DDR3 RAM sticks are physically the same size as the 184-pin DDRDIMMs, but the guide notch is in a different location. DDR3 uses a 240-pin DIMM (see Figure4.10) that's not compatible with DDR RAM slots or motherboards. DDR3 is triple-channel architecture and performs faster at higher frequencies but at lower voltages, thus generating less heat. The laptop version of DDR3 is called a 204-pin SO-DIMM.

Figure 2.5:A 240-pin DDR3 DIMM

- **288-pin DDR4 DIMMs:** DDR4 functionality and operations supported as defined in the component data sheet • 288-pin, registered dual in-line memory module (RDIMM) • Fast data transfer rates: PC4-2666 or PC4-2400 • 4GB (512 Meg x 72) • VDD= 1.20V (NOM) • VPP= 2.5V (NOM) • VDDSPD= 2.5V (NOM) • Supports ECC error detection and correction • Nominal and dynamic on-die termination (ODT) for data, strobe, and mask signals • Low-power auto self-refresh (LPASR)

Figure 2.6:A 288-pin DDR4 DIMM.

- **287/288-Pin DDR5 UDIMM:** This specification defines the electrical and mechanical requirements for 287-pin and 288-pin, 1.1V (VDD), • VPP= 1.8V (NOM) • VDDSPD= 2.5V (NOM), double data rate, synchronous DRAM, unbuffered memory modules (DDR5 SDRAM UDIMMs). Density supported 16Gb, 24Gb, 32Gb, 64Gb.Sideband access with I3C-basic/I2C support. • Two independent I/O sub channels for increased bandwidth. These DDR5 UDIMMs are intended for use as main memory when installed in PCs.

Figure 2.7: A 288-pin DDR5UDIMM.

My PC's DRAM:

Manufacturer: G.Skill

Capacity of each RAM Module: 8GB

Voltage: 1.360V

Maximum Frequency: 3200 MHz.

Current Frequency: 1599.1MHz.

Type of DRAM: DDR4.

3. Removing and Installing RAM

Although RAM installation is one of the simpler PC hardware upgrades, it's still importance to follow the correct steps and to take all appropriate safety precautions. Removal and installation procedure vary depending on the type of RAM the system uses. DIMMs and RIMMs snap into the RAM slots vertically. The following steps describe the removal and installation procedure of DIMMs. Follow these steps to remove DIMM or RIMM RAM from PC:

Step 1: Locate the retention clips on either end of the RAM module.

Step 2: Press outward on the clips to disengage them from the retention slots on the sides of the RAM sticks (see Figure 4.9).

Step 3: Press down on the clips firmly and evenly. The retention clips act as levers to lift the DIMM sticks up and slightly out of the RAM slots.

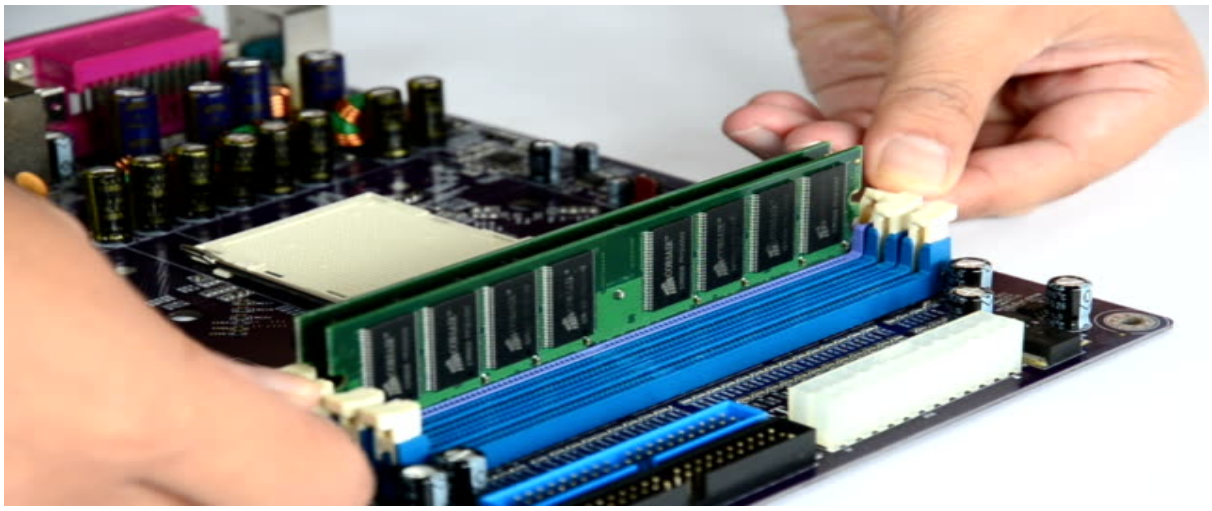

Figure 3.1: Removing a 184-pin DIMM (DDR SDRAM)

Step 4: Remove the DIMM sticks and place them on anti-static mat, or in an anti-static bag.

Step 5: Make note of the following:

- How many pins does the RAM have?

Ans: The DDR4 RAM has 288 pins**.**

- Where are the guide notches located?

Ans: The guide notches located slightly off-center on the connector edge**.**

- What information is on the RAM's label?

Ans:

Figure 3.2: A 288-pin DDR4 DIMM

Step 6: While the system RAM is out, it is a good time to check the condition of the metal contacts on both the RAM sticks and the motherboard RAM sockets. Dirty contacts are fairly rare. If this problem happens, use contact cleaner, available at any electronics store. After examined system RAM and inspected the motherboard RAM sockets, reinstall the RAM as described next.

To install a DIMM or RIMM:

Figure 3.3: install a DIMM or RIMM

Step 1: Orient the DIMM or RIMM so that the guide notches on the RAM module match up to the guide ridges on the RAM socket.

Step 2: Press the RAM stick firmly and evenly straight down into the socket until the retention clips engage the retention notches on the ends of the RAM stick.

Step 3: Snap the retention clips firmly into place.

Figure 3.4: install a DIMM or RIMM

Step 4: Repeat these steps to install other RAM modules as appropriate. If using RIMM RAM, don't for get to install the continuity RIMM (CRIMM) sticks into any empty RAM slots. To finish a RAM installation professionally, follow these steps:

Step 1: Once system RAM is in place, reattach any cables that may have had to move, and plug in the system power cable. Do not reinstall the PC case cover until after confirmed that RAM installation was successful.

Step 2: Boot up the system and watch the RAM count to confirm that it installed correctly. Warning: If system has any problems when reboot, must turn off the power and unplug the computer again before reseating the RAM.

4. Exploring RAM Specifications with CPU-Z

CPU-Z Utility reads the specifications of different PC Components from information embedded those components. To explore the different characteristics of RAM, look after the following steps.

Step 1: Launch the CPU-Z application.

Step 2: Navigate to the Memory tab. The CPU-Z utility displays the current statistics of the RAM installed, as shown in Figure 4.1 & 4.2.

Using the data gathered by CPU-Z, record the following information:

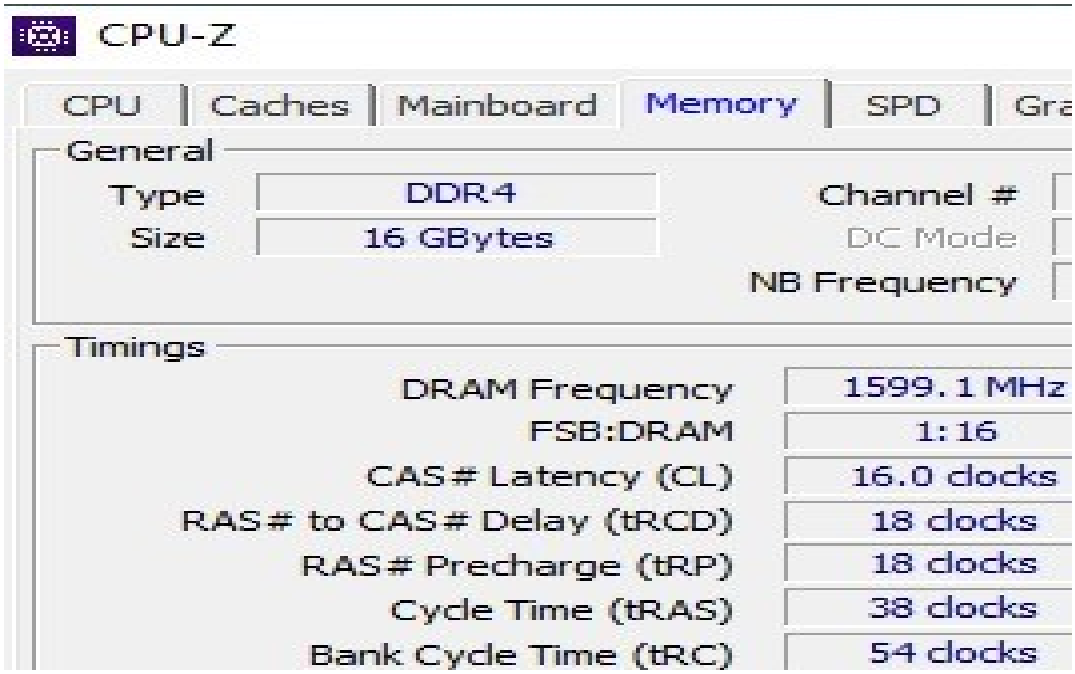

Figure 4.1: CPU-Z showing RAM information

In Memory tab:

- **Type:** Type refer to the what kind of memory it is. My memory type is DDR4.
- **Size:** Size refer to the amount of capacity have that RAM. In my PC, the size of my RAM is 16GB.
- **Channel:** Memory channels are the links between your RAM and your CPU through which data moves between the two. My RAM supports dual channel.

- **DRAM Frequency:** DRAM (Dynamic Random Access Memory) frequency is the percentage of data transferred per second on the data wire. My RAM frequency is 933.4 MHz.
- **FSB:DRAM:** The ratio by which the front side bus (FSB) is multiplied to get the memory frequency (DRAM rate). In my case, it is 'asynch'.
- **CAS# Latency (CL):**Column address strobe latency, also called CAS latency or CL, is the delay in clock cycles between the READ command and the moment data is available. In asynchronous DRAM, the interval is specified in nanoseconds (absolute time). In synchronous DRAM, the interval is specified in clock cycles. In my case, it is 13.0 clocks
- **RAS# to CAS# Delay (tRCD):**RAS to CAS Delay (Row Access Strobe to CAS Delay), or tRCD, specifies the number of clock cycles between the time a row is activated by the row strobe until the column in that row (which defines a memory cell or bit) can be read or written. In my RAM it is 13 clocks.
- **RAS# Precharge (tRP):** tRP refers to the length of time between disabling access to one line and initiating access to another line. In my RAM it is 13 clocks.
- **Cycle time (tRAS) :**Also known as "Activate to Pre-charge Delay" or "Minimum RAS Active Time", the tRAS is the minimum number of clock cycles required between a row active command and issuing the pre-charge command. In my RAM it is 31 clocks.
- **Bank Cycle time (tRc):**The minimum time in cycles it takes a row to complete a full cycle. This can be determined by; tRC = tRAS + tRP. If this is set too short it can cause corruption of data and if it is to high, it will cause a loss in performance, but increase stability. In my RAM it is 44 clocks.
- **Command Rate** : Command Rate is the number of clock cycles the ram needs to receive and execute a command. 1t means one clock cycle. 2t means 2 clock cycles. In my case it is 2T.

Step 3: Click the SPD tab in CPU-Z.

Step 4: The SPD tab, shown in Figure 4.2, lists a number of technical bits of information about aparticular stick of RAM. This information is contained on every SDRAM stick on an additional chipcalled the serial presence detect (SPD) chip.

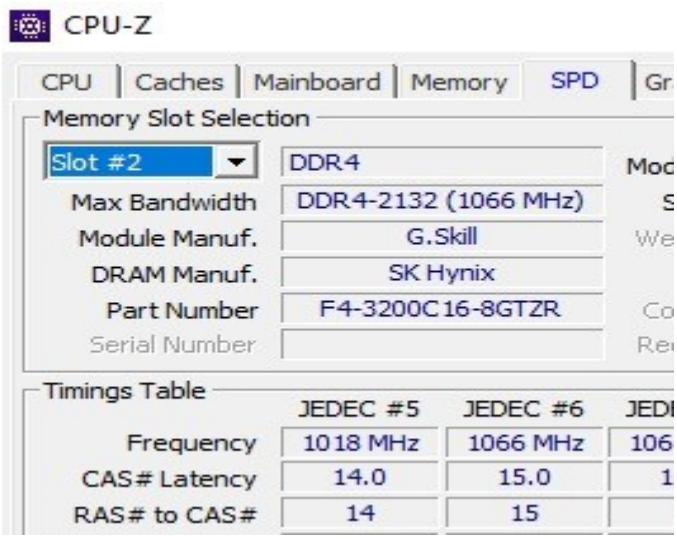

Figure 4.2: CPU-Z showing SPD information1

- **Slot#:**There are four slots in my motherboard for DRAM. In slot #2 DDR4 RAM is installed in my PC.
- **Module-Size:** 8GBytes or the RAM stick capacity is 8GB.
- **Max Bandwidth:** The maximum memory bandwidth is the maximum rate at which data can be read from or stored into a semiconductor memory by the processor (in GB/s). In my case, it isDDR4-2132(1066 MHz)
- **SPD Ext:** XMP is an extension of SPD which provides higher frequencies and tighter timings for your memory to run at. In my case it is supported XMP 2.0
- **Module manuf:** Refer to who produce this or bring into the market. My RAM manufacturer is G.Skill.
- **DRAM manuf:** Refer to who develop this DRAM. My DRAM manufacturer is SK Hynix.
- **Part Number:** Partnumber provides the manufacturer's model number for that particular RAM module. My part number is F4-3200C16-8GTZR.
- **Ranks**: Single

Timing Table:

	JEDEC #5	JEDEC #6	JEDEC #7	XMP-3200
Frequency	1018 MHz	1066 MHz	1066 MHz	1600 MHz
CAS# Latency	14.0	15.0	16.0	16.0
RAS# to CAS#	14	15	15	18
RAS# Precharge	14	15	15	18
tRAS	34	36	36	38
tRC	48	50	50	56
Command rate	N/A	N/A	N/A	N/A
Voltage	1.20 v	1.20v	1.20v	1.350 v

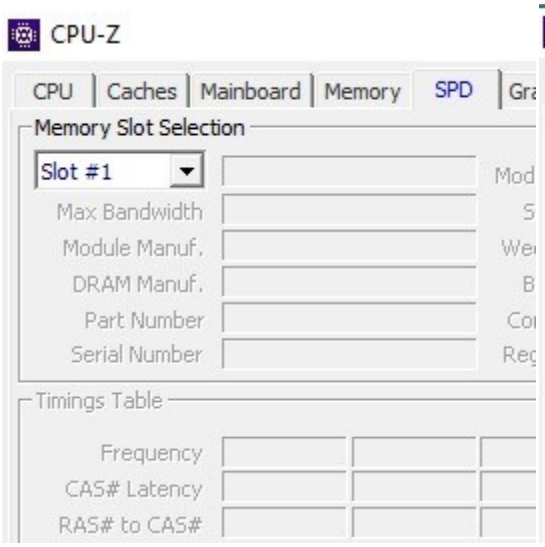

Figure 4.3: CPU-Z showing SPD information 1

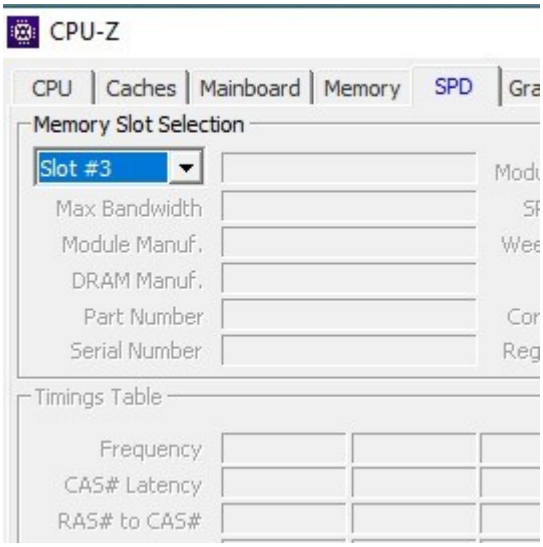

Figure 4.4: CPU-Z showing SPD information 3

As I installed the same manufacturer, same model and size RAM in my PC, so all the others (each) slots information is same. I install four RAM into the four RAM Slots.

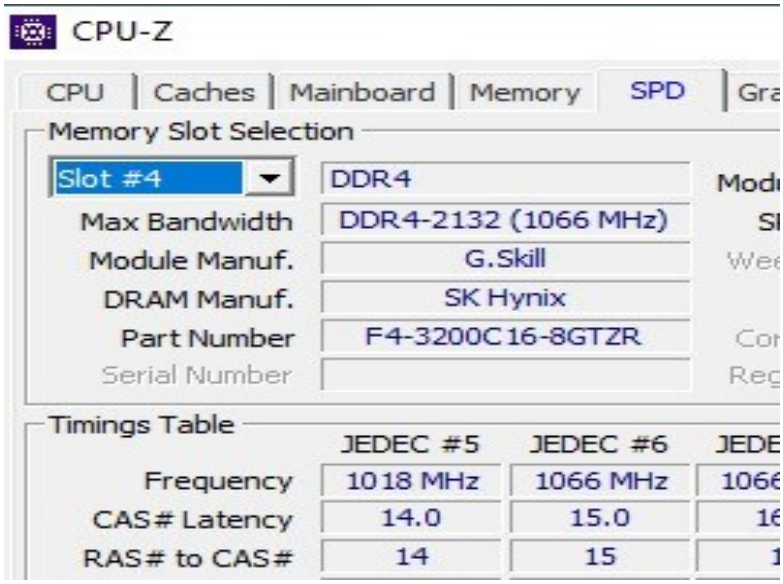

Figure 4.5: CPU-Z showing SPD information4

Using the data gathered by CPU-Z, record the following information for each of the system's RAM modules:

	Module 1	Module 2	Module 3	Module 4
Slot#	1	2	3	4
Module Size		8GBytes		8GBytes
Maximum Bandwidth		1066 MHz		1066 MHz
Manufacture		G.Skill		G.Skill

Step 5: If possible, launch CPU-Z on various machines to compare the characteristics of different types of RAM. Now, Use the following terms to complete the following sentences. Not all terms will be used.168-pin DIMM, 184-pin DIMM, 240-pin DIMM, CRIMM, DIMM, DDR RAM, DDR2 RAM, DDR3 RAM, dual-channel, megabytes (MB), RIMM, SDRAM, SO-DIMM, SPD.

I. **Today's PCs use DDR3 RAM, which comes in a(n) 240-pin DIMM package.**
II. **A RAM module used in a laptop is called a(n) SO-DIMM.**
III. **A component known as a(n) SPD chip provides additional information about an SDRAM module.**
IV. **A stick of DDR RAM looks a lot like a 168-pin DIMM, but it has 184 pins.**

V. **The technology that uses two sticks of RAM together to increase throughput is known as dual-channel architecture.**

VI. **When purchasing DDR3 RAM, you must realize that it is not backward compatible with DDR2 RAM, and new hardware must be considered.**