Assignment 1 BSCS-F19-M65-B SHABAN ZAMAN

Q) What is the motherboard? Differentiate between Northbridge and Southbridge by explaining and listing the components of each.

As shown from its name, it is obvious that the motherboard acts as the mother of all components of the computer, it is the main circuit board that connects the components like CPU, GPU, RAM, and storage devices, etc.
Each version of Motherboard is designed for a specific variety of CPUs and memory.
It is located inside the computer case.

Following are the components of the Motherboard:

- Expansion Slot
- 3-Pin case fan connector
- Heat Sink
- 4-Pin connector
- Inductor
- Capacitor
- CPU Socket
- Northbridge
- Screw hole
- Memory Slot
- Super I/O
- 24 pin PSU Connector
- Serial ATA Connections
- RAID
- System panel connector
- FWH
- Southbridge
- Serial Port Connector
- USB headers
- Jumpers
- ICs
- 1394 Headers
- CD-IN

Difference Between Northbridge and Southbridge

Definition

A Northbridge is a chip present in the core logic chipset architecture on the northern section of the PC motherboard.
A Southbridge is a chip present in the core logic chipset architecture on the southern section of the PC motherboard.

Location

As their names indicate, Northbridge is located in the northern section of the motherboard in the PC, while southbridge is located in the southern section of the motherboard.

Operating Speed

When it comes to speed, Northbridge operates faster than Southbridge because it is connected directly to the CPU.

Components

Northbridge connects to the faster components of the computer like CPU, RAM, AGP, PCI Express slots, and Southbridge, etc. On the other hand,
Southbridge connects to the PCI bus slots, BIOS, SATA, and IDE connectors, USB ports, and Northbridge.

Conclusion

The main difference between Northbridge at Southbridge is that Northbridge is a chip in the chipset of the motherboard that directly connects to the CPU whereas Southbridge is a chip in the chipset of the motherboard that does not directly connect the CPU. So, northbridge connects to faster components and southbridge connects to slower components.

Main differences between both:

NORTHBRIDGE
VERSUS
SOUTHBRIDGE

NORTHBRIDGE	SOUTHBRIDGE
A chip in the core logic chipset architecture on the northern section of the PC motherboard	A chip in the core logic chipset architecture on the southern section of the PC motherboard
Located in the northern section of the motherboard	Located in the southern section of the motherboard
Directly connected to the CPU	Connects to the CPU via northbridge
Connects to the CPU, RAM, AGP, PCI Express slots and southbridge	Connects to the PCI bus slots, BIOS, SATA and IDE connectors, USB ports and northbridge
Faster	Not as fast

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Q) List 5 manufacturers of microprocessors and briefly describe CPU structure.

There are several manufacturers of microprocessors, but we are going to talk about only 5 here. Following are the five most popular manufacturers of microprocessors.

1) Intel Corp (INTC)
2) Advanced RISC Machines (ARM)
3) Qualcomm Inc (QCOM)
4) NVIDIA Corp (NVDA)
5) Advanced Micro Devices (AMD)

1) Intel Corp (INTC)

Intel Corporation is an American multinational technology company.
Its headquarters are situated in Santa Clara, California.
Intel's top rivals include AMD, Samsung Electronics, IBM, and NVIDIA.
The slogan of Intel is "Sponsors of Tomorrow", "Look Inside", "Experience what's Inside".

2) Advanced RISC Machines (ARM)

ARM is the top leading most advanced provider of processors,
It offers the widest range of microprocessors for the performance and cost requirements of every device.
Well-known CPUs and NPUs of ARM are Cortex-A, Cortex-M, Cortex-R, Ethos, and Neoverse.

3) Qualcomm Inc (QCOM)

Qualcomm is also an American multinational corporation.
Its headquarters are situated in San Diego, California, and incorporated in Delaware.
It is known for creating intellectual property, semiconductors, software, and services related to wireless technology. It owns rights to the CDMA2000, TD-SCDMA, and WCDMA mobile communications standards.
It has more hold in the Mobile Processors Market.

4) NVIDIA Corp (NVDA)

Nvidia Corporation is an American multinational technology company and its headquarters are in Delaware and Santa Clara, California.
It designs graphical microprocessors for the gaming and professional graphics work, as well as for the mobile computing and automotive market.
In Graphical Microprocessors, NVIDIA and AMD are the biggest rivals.
The most recent GPUs series by NVIDIA is the 3000 series.

5) Advanced Micro Devices (AMD)

Advanced Micro Devices, Inc. is an American multinational microprocessor company.
Its headquarters are located in Santa Clara, California. It develops computer processors and related technologies for businesses and customers.
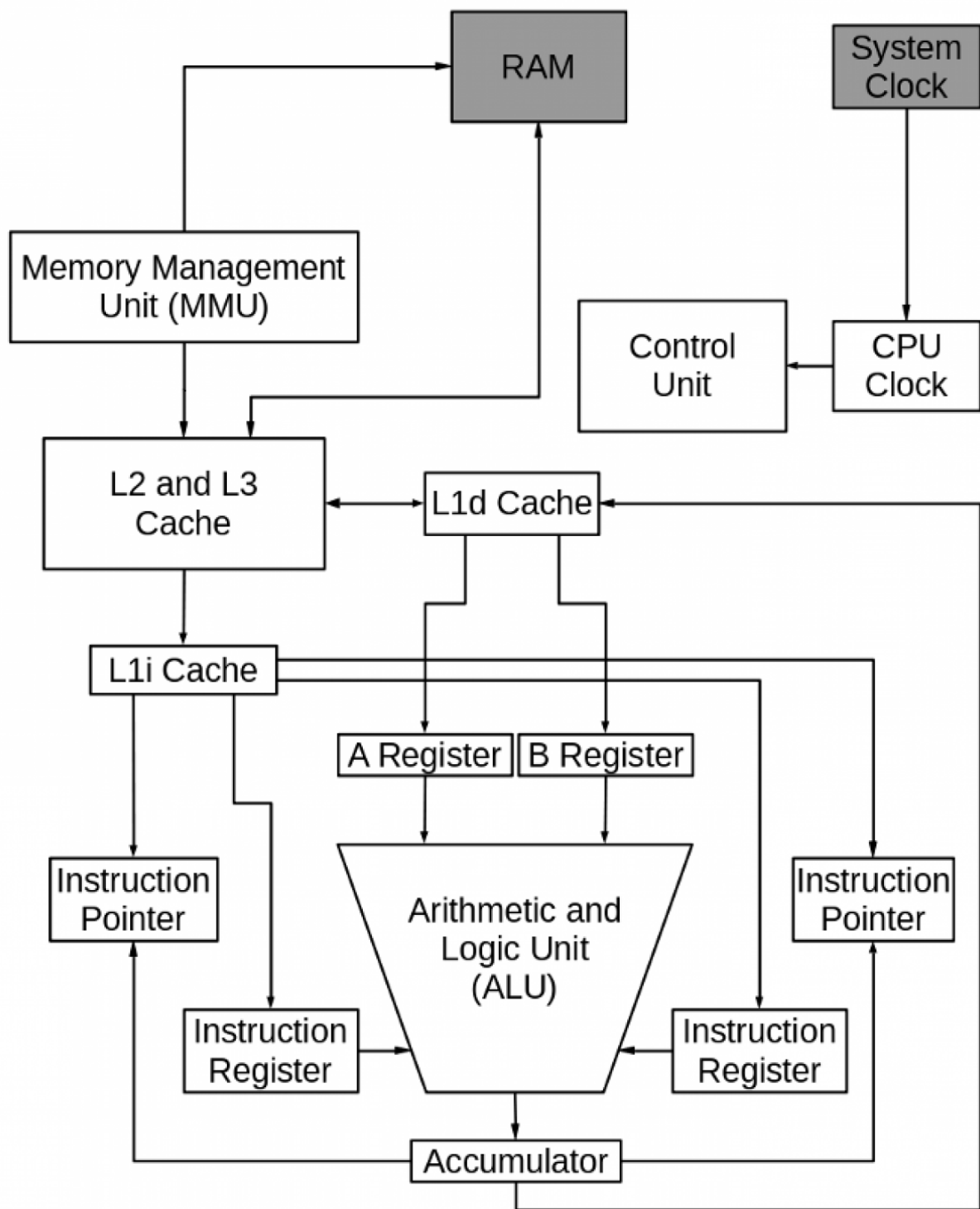It was founded on May 1, 1969, and its current CEO is Lisa Su.
Its most Powerful CPU series is the Ryzen Threadripper.
If we compare, AMD's chips offer more performance on both the mainstream desktop and HEDT platforms, so they are also more expensive than Intel's respective flagships. You do not need to drop major dollars to see the advantages of AMD's chips.
When it comes to CPUs, AMD and Intel are the biggest rivals.

CPU STRUCTURE

RAM

System
Clock

Memory Management
Unit (MMU)

Control
Unit

CPU
Clock

L2 and L3
Cache

L1d Cache

L1i Cache

A Register

B Register

Instruction
Pointer

Arithmetic and
Logic Unit
(ALU)

Instruction
Pointer

Instruction
Register

Instruction
Register

Accumulator

Parts of a CPU

1. **ALU**: The arithmetic and logic unit processes all the calculations in the CPU.
2. **CU**: Control unit controls how the data moves around the PC.

Registers

A memory location within the actual processor that works at amazingly fast speeds. It stores info about what is to be executed or decoded.

1. **PC**: program counter – it stores the address of the next instruction in the RAM
2. **MAR**: memory address register – it stores the address of the instructions currently executing.
3. **MDR**: memory data register – it stores the data which is to be fetched from memory or sent to it.
4. **CIR**: current instruction register - it stores the actual instruction which is executed after being decoded.
5. **ACC**: accumulator – it stores the result of processed calculations

Buses

1. **Address bus**: it carries the ADDRESS of the instruction or data.
2. **Data bus**: it carries data between the processor and the memory.
3. **Control bus**: it sends control signals such as memory read, memory write.

These buses are also referred to as the "front-side bus" or "system bus".

The cache is a very small amount of memory that is present inside the CPU – it is closer to the CPU than to RAM. It is used temporarily to hold frequently used data and instructions.
Every time before requesting data from RAM, The CPU CU automatically checks the cache for those instructions.

This saves the time wasted in fetching the instructions and data from RAM again and again. It is a slower process that may keep the CPU hold. Retrieving the data from the cache takes less time than transferring to and from RAM.

If there is more cache in the PC, more and more data can be stored closer to the CPU.

The cache is **graded** as Level 1 (L1), Level 2 (L2), and Level 3 (L3)

- **L1** is usually part of the CPU chip itself and is both the smallest and the fastest to access. Its normal size is between 8 MB and 24 MB.

- **L2** and **L3** caches are bigger than **L1**.

  These are the extra layers of caches built between the RAM and the CPU. Sometimes L2 is embedded inside the CPU along with L1. L2 and L3 caches are a bit slower than L1. If there is more L2 and L3 memory available, the PC will run faster.

Only a small amount of physical space is allocated for the cache. RAM gets far more space than cache, and it is usually larger and cheaper.

Each core of the CPU has its L1 cache, but it can have L2 and L3 caches too.

Q) What is the number system? Explain briefly about binary and hexadecimal number systems by
adding examples and comparisons into your answer.

__Definition__

A number system is defined as the way of representing the numbers in any form or notation in already described symbols, the most commonly used number system is the Decimal number system which has a base of 10.
The same sequence of digits may represent a different number in other numbers systems.
So, we should mention with the number which number system it is composed of.

The four most common number system types are:
- Decimal **number system** (Base- 10)
- Binary **number system** (Base- 2)
- Octal **number system** (Base-8)
- Hexadecimal **number system** (Base- 16)

Binary Number System

Binary numbers are also called Base-2 numbers systems and they consist of only 0s and 1s.
To convert a number from a Decimal Number system to Binary Number System, we will have to divide the number with the 2 until the remainder becomes zero, then we will note down all the remainders per division which are 0s and 1s, and then we will write them in order from down to up.

Successive Division by 2

```
2 | 29
  2 | 14
    2 | 7
      2 | 3
        2 | 1
            0
```

Remainders

1   LSB

0

1

1

1   MSB

Read the remainders from the bottom up

29 decimal = 11101 binary

Adding numbers in Binary Number System

While adding a binary number, we add the digits one by one and if both of them are zero then the summed result is 0 and if any of both digits is 1 and the other one is 0 then the answer will be 1 and if both of them are 1 then the result will be 0 and 1 carry will go to the next digit.

Addition		Result	Carry
0 + 0	=	0	0
0 + 1	=	1	0
1 + 0	=	1	0
1 + 1	=	0	1

Hexadecimal Number System

Hexadecimal is a number system in which the numbers are represented with the base 16. Every number is divided with the number 16 and the remainder is counted from down to up. From one to nine it is counted as it is. From 10 to 15 it is counted as the alphabets from A to F.
 We can know easily from looking at the number that it's hexadecimal because it has the alphabet in it. Here is the process of how to convert the decimal into hexadecimal.

Conversion of decimal numbers into hexadecimal numbers

16	423	Remainder
16	26	7 ↑
16	1	A
	0	1

Hex	Decimal
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15

Adding Numbers in Hexadecimal System

To add the numbers in the hexadecimal system we will add the numbers like we do in the decimal number system but replace the alphabets from A to F with 9 to 15 and again convert the final result with the valid alphabets where possible.

$4A6_{16} + 1B3_{16} = 659_{16}$

$$
\begin{array}{rl}
1 & \text{carry} \\
4\,A\,6 & = 1190_{10} \\
+\,1\,B\,3 & = 435_{10} \\
\hline
6\,5\,9 & = 1625_{10}
\end{array}
$$

Comparison between Hexadecimal and Binary numbers.

2 5 1 2
base-ten (decimal)

1 0 0 1 1 1 0 1 0 0 0 0
base-two (binary)

0 x 9 D 0
base-sixteen (hexadecimal)

Number	0	1	2	3	4	5	6	7
Binary	0000	0001	0010	0011	0100	0101	0110	0111
Hexadecimal	0	1	2	3	4	5	6	7

Number	8	9	10	11	12	13	14	15
Binary	1000	1001	1010	1011	1100	1101	1110	1111
Hexadecimal	8	9	A	B	C	D	E	F

Sources
Wikipedia
BBC.co.uk
Pediaa