**Batch: C2 Roll No.: 16010122267**

**Experiment / assignment / tutorial No. 1**

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| **TITLE:** Study of PCI and SCSI. |

**AIM: To Study and learn PCI and SCSI**

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**Expected OUTCOME of Experiment : (Mention CO/CO’s attained here )**

CO1: Describe and define the structure of a computer with buses structure and detail working of the arithmetic logic unit and its sub modules.

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1. [**https://www.techopedia.com/definition/8815/peripheral-component-interconnect-bus-pci-bus**](about:blank)
2. [**https://www.techopedia.com/definition/331/small-computer-system-interface-scsi**](about:blank)
3. [**http://www.csun.edu/~edaasic/roosta/BUS\_Structures.pdf**](about:blank)
4. W.Stallings William “Computer Organization and Architecture: Designing for Performance”, Pearson Prentice Hall Publication, 7thEdition. C.

**Pre Lab/ Prior Concepts:**

Microcomputer buses which communicate with a peripheral devices or a memory location through communication lines called buses.

The major parts of microcomputers are central processing unit (CPU), memory, and input and output unit. To connect these parts together through three sets of parallel lines, called buses.  These three buses are  Address bus, data bus, and Control bus.

**Address Bus:**

The address bus consists of 16, 20, 24, or more parallel signal lines, through which the CPU sends out the address of the memory location. This memory location is used for to written to or read from. The number of memory location is depends on 2 to the power N address lines.  Example, a CPU with 16 address lines can address 216 or 65,536 memory locations. When the CPU reads data from or writes data to a port. The port address is also sent out on the address bus. This is unidirectional. This means that the CPU can send data to a memory location or I/O ports.

**Data Bus:**

The data bus consists of 8, 16, 32 or more parallel signal lines. The data bus lines are bidirectional. This means that the CPU can read data from memory or from a I/O port as well as send data to a memory location or to a I/O port. In a system, many output devices are connected to the data bus, but only one device at a time will be enabled to the output.

**Control Bus:**

The control bus consists of 4-10 parallel signal lines. The CPU sends out signals on the control bus to enable the outputs of addressed memory devices or port devices. Typically control bus signals are memory read, memory write, I/O read and I/O write. To read a data from a memory location, the CPU sends out the address of the desired data on the address bus and then sends out a memory read signal on the control bus. The memory read signal enables the addressed memory device to output the data onto the data bus where it is read by the CPU.

**PCI Bus**

PCI, which stands for Peripheral Component Interconnect, served as a prevalent standard data transfer method in computers roughly from 1993 to around 2007. During this period, it functioned as the primary means for connecting expansion cards such as sound cards, network cards, and more. Operating in a parallel manner, its prevalent form featured a clock speed of 66 MHz and came in either 32 or 64-bit widths. However, its role has been succeeded by PCI Express, a serial transport technology that diverges from the parallel nature of PCI. A PCI port, or more precisely, a PCI slot, functions as the interface through which expansion cards are connected to the system. When not in use, it remains inert and inactive.

**Functions:**

* PCI slots are used for installing various components such as sound cards, Ethernet cards, wireless cards, and modern NVMe SSDs.
* NVMe SSDs provide significantly faster speeds compared to traditional SATA SSDs when connected through PCI slots.
* PCI slots also allow for the addition of discrete graphics cards to enhance graphical performance.
* The primary purpose of PCI slots is to accommodate expansion cards on a motherboard.
* Expansion cards extend a computer's capabilities beyond what the motherboard alone can provide.
* Expansion card benefits include improved graphics, enhanced audio, additional USB and hard drive controllers, and expanded networking options.

**Architecture:**

* Architecture of PCI : PCI 32 bits have a transport speed of 33 MHz and work at 132 MBps.
* PCI 64 bits have a transport speed of 33 MHz and work at 264 MBps.
* PCI 64 bits have a transport speed of 66 MHz and work at 512 MBps.
* PCI 64 bits have a transport speed of 66 MHz and work at 1 GBps.

**Advantage of PCI :**

* You’ll interface a greatest of five components to the PCI and you’ll be able moreover supplant each of them by settled gadgets on the motherboard.
* You have different PCI buses on the same computer.
* The PCI transport will improve the speed of the exchanges from 33MHz to 133 MHz with a transfer rate of 1 gigabyte per second.
* The PCI can handle gadgets employing a greatest of 5 volts and the pins utilized can exchange more than one flag through one stick.

**Disadvantage of PCI :**

* PCI Graphics Card cannot get to system memory.
* PCI does not support pipeline.

**SCSI bus:**

SCSI(Small Computer System Interface) serves as a data transfer conduit linking computers, laptops, and peripheral devices. These peripherals encompass items like disks, CD-ROMs, printers, and communication equipment

**Function of SCSI:**

* **Data Transfer:** SCSI is instrumental in enabling swift data transfer between the CPU and peripheral devices. The data transfer rate of SCSI devices can vary based on the interface type and device capabilities, potentially reaching up to 160 MB/s.
* **Device Control:** Host computers can manage SCSI devices through an array of commands. These commands empower the host to execute tasks such as data reading and writing, disk formatting, and command queue management.

**Architecture of SCSI:**

SCSI permits simultaneous utilization of multiple peripherals without compromising performance.

**SCSI Specifications:**

* **SCSI-1:** Originating in 1986, SCSI-1 has become obsolete. It featured an 8-bit bus width and a clock speed of 5 MHz.
* **SCSI-2:** Embraced in 1994, SCSI-2 introduced the Common Command Set (CCS) comprising 18 essential commands for supporting any SCSI device. It also provided the option to double the clock speed to 10 MHz (Fast), expand the bus width to 16 bits, and increase device capacity to 15 (Wide), or implement both enhancements (Fast/Wide).
* **SCSI-3:** Most SCSI-3 specifications are prefaced with "Ultra," such as Ultra for SPI variations, Ultra2 for SPI-2 variations, and Ultra3 for SPI-3 variations. The designations of Fast and Wide mirror their SCSI-2 counterparts. SCSI-3 represents the prevailing standard in use today.

**Advantages of SCSI:**

* **Independent Controller:** SCSI comes with its dedicated controller, simplifying troubleshooting processes and reducing reliance on other devices for optimal performance.
* **Single Cable Data Exchange:** Data exchanges take place via a single cable, streamlining the overall connection setup.
* **Compatibility:** SCSI devices can function with a diverse range of computers, enhancing their versatility.
* **Accessibility:** SCSI equipment is readily accessible, facilitating the replacement and upgrading of older SCSI components.

**Disadvantages of SCSI:**

* **Cost:** SCSI drives can be expensive, which might make them less budget-friendly.
* **Configuration Complexity:** The SCSI interface can be challenging to configure, especially when dealing with peripherals. It often requires the expertise of IT professionals for proper management and installation.
* **Performance Degradation:** Over time, the performance of SCSI devices can degrade, potentially affecting their efficiency and speed.

**Post Lab Descriptive Questions**

**Q1 . Differentiate between PCI and SCSI Bus**

**Ans:**

|  |  |
| --- | --- |
| PCI | SCSI |
| Peripheral Component Interconnect (PCI), as its name implies is a standard that describes how to connect the peripheral components of a system together in a structured and controlled way. | SCSI is standard electronic interfaces that allow personal computers to communicate with peripheral hardware such as disk drives, tape drives etc. |
| PCI bus was created by Intel in 1993. PCI bus can transfer 32 or 64 bits at one time. PCI bus can run at 33 Mhz. | It is a high-performance bus which is used for fast disks, scanners, and for devices which require high bandwidth. It has a data rate of 160 MB/s. |
| Typical bandwidth is 80 m/s | Typical bandwidth is 1.5 to 40 m/s |
| Bus type is Backplane | Bus type is I/O |

**Q2. List two applications each of PCI and SCSI Bus**

**Ans:**

**PCI (Peripheral Component Interconnect):**

1. Graphics Cards: PCI slots are commonly used to install discrete graphics cards in computers. These cards significantly enhance graphical capabilities for tasks such as gaming, video editing, and graphic design.
2. Sound Cards: PCI slots can also be utilized for sound cards, which provide improved audio quality and features compared to onboard audio solutions. This is beneficial for professional audio editing, music production, and immersive gaming experiences.

**SCSI (Small Computer System Interface):**

1. Hard Drives and SSDs: SCSI interfaces have historically been used for connecting high-performance hard drives and SSDs, particularly in enterprise environments where fast data transfer rates and reliable connections are crucial.
2. High-End Printers: SCSI connections have been employed for connecting high-end printers and imaging devices, especially in scenarios requiring precise and quick data transmission for professional printing and graphics work.

**Date: 25/08/2023**

**Batch: Roll No.:**

**Experiment / assignment / tutorial No.\_\_\_\_\_\_\_**

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| **TITLE:** To study and implement Booth’s Multiplication Algorithm. |

**AIM:** Booth’s Algorithm for Multiplication

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**Expected OUTCOME of Experiment: (Mention CO/CO’s attained here)**

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**Books/ Journals/ Websites referred:**

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, TataMcGraw-Hill.
2. William Stallings, “Computer Organization and Architecture: Designing for Performance”, Eighth Edition, Pearson.

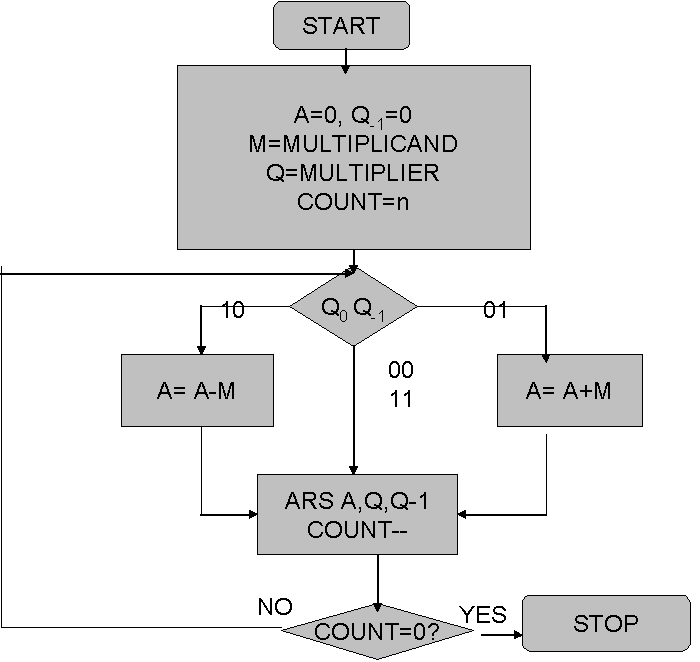
3. Dr. M. Usha, T. S. Srikanth, “Computer System Architecture and Organization”, First Edition, Wiley-India.

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**Pre Lab/ Prior Concepts:**

It is a powerful algorithm for signed number multiplication which generates a 2n bit product and treats both positive and negative numbers uniformly. Also the efficiency of the algorithm is good due to the fact that, block of 1’s and 0’s are skipped over and subtraction/addition is only done if pair contains 10 or 01

**Flowchart:**

****

**Design Steps**:

1. Start
2. Get the multiplicand (M) and Multiplier (Q) from the user
3. Initialize A= Q-1 =0
4. Convert M and Q into binary
5. Compare Q0 andQ-1 and perform the respective operation.

|  |  |
| --- | --- |
| **Q0 Q-1** | **Operation** |
| 00/11 | Arithmetic right shift |
| 01 | A+M and Arithmetic right shift |
| 10 | A-M and Arithmetic right shift |

6. Repeat steps 5 till all bits are compared

7. Convert the result to decimal form and display

8. End

Example: (Handwritten solved problem needs to be uploaded)

**Conclusion:**

**Post Lab Descriptive Questions**

1. **Explain advantages and disadvantages of Booth’s algorithm.**
2. **Is Booth’s recoding better than Booth’s algorithm? Justify**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

**Batch: Roll No.:**

**Experiment / assignment / tutorial No.\_\_\_\_\_\_\_**

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| --- |
| **TITLE :** To study and implement Restoring method of division |

**AIM :** The basis of algorithm is based on paper and pencil approach and the operation involves repetitive shifting with addition and subtraction. So the main aim is to depict the usual process in the form of an algorithm.

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**Expected OUTCOME of Experiment: (Mention CO /CO’s attained here)**

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2. William Stallings, “Computer Organization and Architecture: Designing for Performance”, Eighth Edition, Pearson.

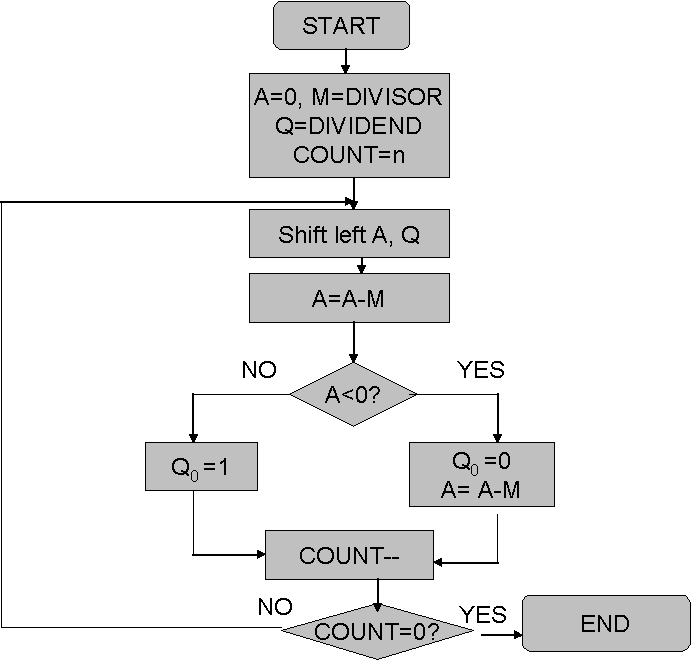
**3**. Dr. M. Usha, T. S. Srikanth, “Computer System Architecture and Organization”, First Edition, Wiley-India.

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**Pre Lab/ Prior Concepts:**

The Restoring algorithm works with any combination of positive and negative numbers

**Flowchart for Restoring of Division:**



**Design Steps**:

1. Start
2. Initialize A=0, M=Divisor, Q=Dividend and count=n (no of bits)
3. Left shift A, Q
4. If MSB of A and M are same
5. Then A=A-M
6. Else A=A+M
7. If MSB of previous A and present A are same
8. Q0=0 & store present A
9. Else Q0=0 & restore previous A
10. Decrement count.
11. If count=0 go to 11
12. Else go to 3
13. STOP

**Example:- (Handwritten solved problems needs to be uploaded)**

**Conclusion**

**Post Lab Descriptive Questions**

1. **What are the advantages of restoring division over non restoring division?**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

**Batch: Roll No.:**

**Experiment / assignment / tutorial No.\_\_\_\_\_\_\_**

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| --- |
| **TITLE :** To study and implement Non Restoring method of division |

**AIM :** The basis of algorithm is based on paper and pencil approach and the operation involve repetitive shifting with addition and subtraction. So the main aim is to depict the usual process in the form of an algorithm.

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**Expected OUTCOME of Experiment: (Mention CO/CO’s attained here)**

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**Pre Lab/ Prior Concepts:**

The Non Restoring algorithm works with any combination of positive and negative numbers.

**Flowchart for Non Restoring of Division( Students need to draw)**

**Example: (Handwritten solved problem needs to uploaded)**

**Conclusion**

**Post Lab Descriptive Questions**

**What are the advantages of non restoring division over restoring division?**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

**Batch: Roll No.:**

**Experiment / assignment / tutorial No.\_\_\_\_\_\_\_**

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| **TITLE: Implementation of IEEE-754 floating point representation** |

**AIM:** To demonstrate the single and double precision formats to represent floating point numbers.

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**Expected OUTCOME of Experiment: (Mention CO attained here)**

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**Pre Lab/ Prior Concepts:**

The IEEE Standard for Floating-Point Arithmetic (IEEE 754) is a [technical standard](about:blank) for [floating-point](about:blank) computation established in 1985 by the [Institute of Electrical and Electronics Engineers](about:blank) (IEEE). The standard [addressed many problems](about:blank#IEEE_754_design_rationale) found in the diverse floating point implementations that made them difficult to use reliably and [portably](about:blank). Many hardware [floating point units](about:blank) now use the IEEE 754 standard.

The standard defines:

* *arithmetic formats:* sets of [binary](about:blank) and [decimal](about:blank) floating-point data, which consist of finite numbers (including [signed zeros](about:blank) and [subnormal numbers](about:blank)), [infinities](about:blank), and special "not a number" values (NaNs)
* *interchange formats:* encodings (bit strings) that may be used to exchange floating-point data in an efficient and compact form
* *rounding rules:* properties to be satisfied when rounding numbers during arithmetic and conversions
* *operations:* arithmetic and other operations (such as [trigonometric functions](about:blank)) on arithmetic formats
* *exception handling:* indications of exceptional conditions (such as [division by zero](about:blank), overflow, *etc*

**Example (Single Precision- 32 bit representation )**

**Example (Double Precision- 64 bit representation )**

**Post Lab Descriptive Questions**

**Give the importance of IEEE-754 representation for floating point numbers?**

**Conclusion**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

**Batch: Roll No.:**

**Experiment / assignment / tutorial No.\_\_\_\_\_\_\_**

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| **TITLE: Implementation of LRU Page Replacement Algorithm.** |

**AIM:** The LRU algorithm replaces the least recently used that is the last accessed memory block from user.

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**Expected OUTCOME of Experiment: (Mention CO/CO’s attained here)**

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**Pre Lab/ Prior Concepts:**

It follows a simple logic, while replacing it will replace that page which has least recently used out of all.

a) A hit is said to be occurred when a memory location requested is already in the cache.

b) When cache is not full, the number of blocks is added.

c) When cache is full, the block is replaced which is recently used

**Algorithm:**

1. Start
2. Get input as memory block to be added to cache
3. Consider an element of the array
4. If cache is not full, add element to the cache array
5. If cache is full, check if element is already present
6. If it is hit is incremented
7. If not, element is added to cache removing least recently used element
8. Repeat step 3 to 7 for remaining elements
9. Display the cache at very instance of step 8
10. Print hit ratio
11. End

**Example:**

**Post Lab Descriptive Questions**

**1. Define hit rate and miss ratio?**

**2. What is the need for virtual memory**?

**Conclusion**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

**Batch: Roll No.:**

**Experiment / assignment / tutorial No.\_\_\_\_\_\_\_**

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| **TITLE :**Implementation ofFIFO Page Replacement Algorithm |

**AIM:** The FIFO algorithm uses the principle that the block in the set which has been in for the longest time will be replaced

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**Expected OUTCOME of Experiment: (Mention CO/CO’s attained here)**

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**Pre Lab/ Prior Concepts:**

T he FIFO algorithm uses the principle that the block in the set which has been in the block for the longest time is replaced. FIFO is easily implemented as a round robin or criteria buffer technique. The data structure used for implementation is a queue. Assume that the number of cache pages is three. Let the request to this cache is shown alongside.

**Algorithm:**

1. A hit is said to be occurred when a memory location requested is already in the cache.

2. When cache is not full, the number of blocks is added.

3. When cache is full, the block is replaced which was added first

**Design Steps:**

1. Start
2. Get input as memory block to be added to cache
3. Consider an element of the array
4. If cache is not full, add element to the cache array
5. If cache is full, check if element is already present
6. If it is hit is incremented
7. If not, element is added to cache removing first element (which is in first).
8. Repeat step 3 to 7 for remaining elements
9. Display the cache at very instance of step 8
10. Print hit ratio
11. End.

**Example:**

**Post Lab Descriptive Questions**

**1. What is meant by memory interleaving?**

**2. Explain Paging Concept?**

**Conclusion**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

**Batch: Roll No.:**

**Experiment / assignment / tutorial No.\_\_\_\_\_\_\_**

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| **TITLE :** Implementation of Cache Mapping Techniques. |

**AIM:** To study and implement concept of various mapping techniques designed for cache memory.

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**Expected OUTCOME of Experiment: (Mention CO/CO’s attained here)**

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**Books/ Journals/ Websites referred:**

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, TataMcGraw-Hill.
2. Dr. M. Usha, T. S. Srikanth, “Computer System Architecture and Organization”, First Edition, Wiley-India.

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**Pre Lab/ Prior Concepts:**

Cache memory: The cache is a smaller, faster memory which stores copies of the data from the most frequently used main memory locations. As long as most memory accesses are cached memory locations, the average latency of memory accesses will be closer to the cache latency than to the latency of main memory.

2. Hit Ratio: You want to increase as much as possible the likelihood of the cache containing the memory addresses that the processor wants.

**Hit Ratio= No. of hits/ (No. of hits + No. of misses)**

There are only fewer cache lines than the main memory blocks, an algorithm is needed for mapping main memory blocks into cache lines. Further a means is needed for determining which main memory block currently occupies in a cache line. The choice of cache function dictates how the cache is organized. Three techniques can be used.

1. Direct mapping.
2. Associative mapping.
3. Set Associative mapping.

**Direct Mapped Cache**: The direct mapped cache is the simplest form of cache and the easiest to check for a hit. Since there is only one possible place that any memory location can be cached, there is nothing to search; the line either contains the memory information we are looking for, or it doesn't.  
Unfortunately, the direct mapped cache also has the worst performance, because again there is only one place that any address can be stored. Let's look again at our 512 KB level 2 cache and 64 MB of system memory. As you recall this cache has 16,384 lines (assuming 32-byte cache lines) and so each one is shared by 4,096 memory addresses. In the absolute worst case, imagine that the processor needs 2 different addresses (call them X and Y) that both map to the same cache line, in alternating sequence (X, Y, X, Y). This could happen in a small loop if you were unlucky. The processor will load X from memory and store it in cache. Then it will look in the cache for Y, but Y uses the same cache line as X, so it won't be there. So Y is loaded from memory, and stored in the cache for future use. But then the processor requests X, and looks in the cache only to find Y. This conflict repeats over and over. The net result is that the hit ratio here is 0%. This is a worst case scenario, but in general the performance is worst for this type of mapping.

**Fully Associative Cache:** The fully associative cache has the best hit ratio because any line in the cache can hold any address that needs to be cached. This means the problem seen in the direct mapped cache disappears, because there is no dedicated single line that an address must use.However (you knew it was coming), this cache suffers from problems involving searching the cache. If a given address can be stored in any of 16,384 lines, how do you know where it is? Even with specialized hardware to do the searching, a performance penalty is incurred. And this penalty occurs for all accesses to memory, whether a cache hit occurs or not, because it is part of searching the cache to determine a hit. In addition, more logic must be added to determine which of the various lines to use when a new entry must be added (usually some form of a "least recently used" algorithm is employed to decide which cache line to use next). All this overhead adds cost, complexity and execution time.

**Set Associative Cache (To be filled in by students)**

**Direct Mapping Implementation:**

The mapping is expressed as

**i=j modulo m**

i=cache line number

j= main memory block number

m= number of lines in the cache

* Address length = (s+w) bits
* Number of addressable units = 2s+w words or bytes
* Block size = line size = 2w words or bytes
* Number of blocks in main memory = 2s+w / 2w = 2s
* Number of lines in cache = m = 2r
* Size of tag = (s-r) tags

**Associative Mapping Implementation**: **(To be filled in by students)**

**Set** **Associative Mapping Implementation**:

**Post Lab Descriptive Questions**

**1. For a direct mapped cache, a main memory is viewed as consisting of 3 fields. List and define 3 fields.**

**2. What is the general relationship among access time, memory cost, and capacity?**

**Conclusion**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

**Batch: Roll No.:**

**Experiment / assignment / tutorial No.\_\_\_\_\_\_\_**

|  |
| --- |
| **TITLE:** Implement simple addition, subtraction, multiplication and division instructions using TASM. |

**AIM:** Implement simple addition, subtraction, multiplication and division instructions using TASM.

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**Expected OUTCOME of Experiment: (Mentions the CO/CO’s attained)**

Understand the Central processing unit with addressing modes and working of control unit in depth.

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Books/ Journals/ Websites referred:**

**1) Microprocessor architecture and applications with 8085: By Ramesh Gaonkar (Penram International Publication).**

**2) 8086/8088 family: Design Programming and Interfacing: By John Uffenbeck (Pearson Education).**

**Pre Lab/ Prior Concepts:**

**Assembler directives: These are statements that direct the assembler to do something**

**Definition:**

**Types of Assembler Directives:**

**ASSUME Directive** - The ASSUME directive is used to tell the assembler that the name of the logical segment should be used for a specified segment. The 8086 works directly with only 4 physical segments: a Code segment, a data segment, a stack segment, and an extra segment.

**Example:**

**ASUME CS:CODE** ;This tells the assembler that the logical segment named CODE contains the instruction statements for the program and should be treated as a code segment.

**ASUME DS:DATA** ;This tells the assembler that for any instruction which refers to a data in the data segment, data will found in the logical segment DATA

**Start:**

It is entry point of the program. without this program won’t run.

**END** - END directive is placed after the last statement of a program to tell the assembler that this is the end of the program module. The assembler will ignore any statement after an END directive. Carriage return is required after the END directive.

**ENDS** - This ENDS directive is used with name ofthe segment to indicate the end of that logic segment.

**Example:**

**CODE SEGMENT** ;

Hear it Start the logic

;segment containing code

; Some instructions statements to perform the logical

;operation

**CODE ENDS** ;End of segment named as;CODE

**Arithmetic instruction set:**

**ADD instruction:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Mnemonic** | **Meaning** | **Format** | **Operation** | **Flags** |
|  |  |  |  | **Affected** |
|  |  |  |  |  |
| ADD | Addition | ADD D, S | (S) + (D)🡪(D) | All |
|  |  |  |  |  |
|  |  |  | Carry🡪(CF) |  |
|  |  |  |  |  |
|  |  |  |  |  |
| ADC | Add with | ADC D, S | (S) + (D) +(CF) | All |
|  | Carry |  | 🡪 (D) |  |
|  |  |  | Carry🡪(CF) |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Syntax: ADD destination,source**

**SUB instruction:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Mnemonic** | **Meaning** | **Format** | **Operation** | **Flags Affected** |
|  |  |  |  |  |
| SUB | Subtract | SUB D, S | (D) - (S)🡪(D) | All |
|  |  |  |  |  |
|  |  |  | Borrow🡪(CF) |  |
|  |  |  |  |  |
|  |  |  |  |  |
| SBB | Subtract with | SBB D, S | (D) - (S) –(CF)🡪(D) | All |
|  | Borrow |  |  |  |
|  |  |  |  |  |

**MUL instruction:**

**Syntax: MUL source**

|  |  |  |  |
| --- | --- | --- | --- |
| **Multiplication** | **Multiplicand** | **Operand** | **Result** |
| **(MUL or IMUL)** |  | **(Multiplier)** |  |
|  |  |  |  |
| Byte \* Byte | AL | Register or | AX |
|  |  | Memory |  |
|  |  |  |  |
| Word \* Word | AX | Register or memory | DX :AX |

**DIV instruction:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Division** | **Dividend** | **Operand** | **Quotient : Remainder** |
| **(DIV or IDIV)** |  | **(Divisor)** |  |
|  |  |  |  |
| Word / Byte | AX | Register or memory | AL : AH |
|  |  |  |  |
| Dword / Word | DX:AX | Register or memory | AX : DX |
|  |  |  |  |

**The steps to execute a program in TASM are**

**ASSEMBLING AND EXECUTING THE ROGRAM**

1. **Writing an Assembly Language Program**

Assembly level programs generally abbreviated as ALP are written in text editor EDIT.

Type *EDIT* in front of the command prompt **(C:\TASM\BIN)** to open an untitled text file.

*EDIT<file name>*

After typing the program save the file with appropriate file name with an extension *.ASM*

Ex:Add.ASM

1. **Assembling an Assembly Language Program**

To assumble an ALP we needed executable file called MASM.EXE. Only if this file is in current working directory we can assemble the program. The command is

*TASM<filename.ASM>*

If the program is free from all syntactical errors, this command will give the **OBJEC**T file.In case of errors it list out the number of errors, warnings and kind of error.

**Note: No object file is created until all errors are rectified.**

1. **Linking**

After successful assembling of the program we have to link it to get **Executable file.**

The command is

*TLINK<File name.OBJ>*

This command results in <*Filename.exe>*which can be executed in front of the command prompt.

1. **Executing the Program**

Open the program in debugger by the command(note only exe files can be open)by the command.

*<Filename.exe>*

This will open the program in debugger screen where in you can view the assemble code with the CS and IP values at the left most side and the machine code. Register content,memory content also be viewed using ***TD***option of the debugger & to execute the program in single steps(F7)

**Algorithm for adding the two 8-bit numbers:**

**Algorithm for subtracting the two 8 bit numbers:**

**Algorithm for Subtracting**

**Algorithm for multiplying the two 8 bit numbers:**

**Algorithm for dividing the two 8-bit numbers:**

**Conclusion:**

**Post Lab Descriptive Questions**

**Explain instructions ADC and SBB with example**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

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|  |
| --- |
| **TITLE:** Study of multiprocessor configuration concepts through Virtual lab |

**AIM:** Understanding Virtual Lab concepts

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**Expected OUTCOME of Experiment:**

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**Books/ Journals/ Websites referred:**

[http://vlabs.iitb.ac.in/vlab/labscse.html](about:blank)

[http://vlabs.iitb.ac.in/vlab/#](about:blank)

[http://www.vlab.co.in/](about:blank)

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**Pre Lab/ Prior Concepts:**

The main aim of this experiment is to provide remote-access to Labs in various disciplines of Science and Engineering. These Virtual Labs would cater to students at the undergraduate level, post graduate level as well as to research scholars. Also, to enthuse students to conduct experiments by arousing their curiosity. This would help them in learning basic and advanced concepts through remote experimentation. It also provides a complete Learning Management System around the Virtual Labs where the students can avail the various tools for learning, including additional web-resources, video-lectures, animated demonstrations and self-evaluation. We can share costly equipment and resources, which are otherwise available to limited number of users due to constraints on time and geographical distances

**Salient Features:**

. 1. Virtual Labs will provide to the students the result of an experiment by one of the following methods (or possibly a combination)

* Modeling the physical phenomenon by a set of equations and carrying out simulations to yield the result of the particular experiment. This can, at-the-best, provide an approximate version of the ‘real-world’ experiment.
* Providing measured data for virtual lab experiments corresponding to the data previously obtained by measurements on an actual system.
* Remotely triggering an experiment in an actual lab and providing the student the result of the experiment through the computer interface. This would entail carrying out the actual lab experiment remotely.

2. Virtual Labs will be made more effective and realistic by providing additional inputs to the students like accompanying audio and video streaming of an actual lab experiment and equipment.

**Observations**

**Title of Study Experiment:**

**Brief description of experiment under study**

**Learning’s recorded:**

**Knowledge gained / Inference Obtained :**

**Post Lab Descriptive Questions**

**1. What are the applications of the virtual lab case study / tool reviewed by you?**

**Conclusion**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**