COMPUTER ORGANIZATION
LAB REPORT

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CERTIFICATE

This is to certify that this personal practical file for the purpose of computer organization lab is submitted by

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of **branch Computer Science & Engineering (CSE) ,** during the academic session year 2021-22

I wish him/her bright future ahead.

NAME

(In-charge)

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EXPERIMENT – 1

AIM OF EXPERIMENTS: Study different input output ports using trainer kits.

1.EXPLAIN PC CARDS, FLASH MEMORY CARDS AND USB FLASH DRIVES IN DETAILS.

Ans:

PC cards- In computing, PC Card is a configuration for computer parallel communication peripheral interface, designed for laptop computers.

Flash memory cards- A flash memory card (sometimes called a storage card) is a small storage device that uses nonvolatile semiconductor memory to store data on portable or remote computing devices. Such data includes text, pictures, audio and video. Most current products use flash memory, although other memory technologies are being developed, including devices that combine dynamic random-access memory (DRAM) with flash memory.

USB Flash drives- A USB flash drive is a data storage device that includes flash memory with an integrated USB interface. It is typically removable, rewritable and much smaller than an optical disc.

2.EXPLAIN ALL SPECIAL PURPOSE PORTS.

MIDI ports

MIDI stands for Musical Instrument Digital Interface. This port connects the system unit to a musical instrument like an electronic keyboard. A system unit with a MIDI port can also record sounds created by a synthesizer and then process these sounds. Synthesizer is a peripheral or chip that creates sound from digital instructions.

SCSI port

SCSI stands for Small Computer System Interface. It is a special high-speed parallel port to attach SCSI peripheral devices like disk drives and printers. It can connect up to 15 devices using a daisy chain.

IrDA Port

IrDA stands for Infrared Data Association. It is also called fast infrared (FIR). A wireless device can transmit signals to a computer with IrDA ports. Different devices use IrDA ports like keyboards, mice, printers, and digital cameras etc.

Bluetooth Ports

Bluetooth port is an alternative to IrDA port. It uses radio waves to transmit data between two devices. Bluetooth also enabled devices to communicate with one another without aligned with one another.

*3.*WHAT IS COMPUTER PORTS?

A port is a physical docking point using which an external device can be connected to the computer. It can also be programmatic docking point through which information flows from a program to the computer or over the Internet.
Characteristics of Ports

- External devices are connected to a computer using cables and ports.
- Ports are slots on the motherboard into which a cable of external device is plugged in.
- Examples of external devices attached via ports are the mouse, keyboard, monitor, microphone, speakers, etc.

4.WHAT IS PS*2* DIN CONNECTOR?

The PS/2 (Personal System/2) port, also referred to as the mouse port or keyboard port, was developed by IBM. It is used to connect a computer mouse or keyboard to an IBM compatible computer. The PS/2 port is a mini DIN plug containing six pins and is still sometimes found on all IBM compatible computers.

5.PS2 6 PIN DIN CONNECTOR.

The mini-DIN connectors are a family of multi-pin electrical connectors used in a variety of applications. Mini-DIN is similar to the larger, older DIN connector. Both are standards of the Deutsches Institut für Normung, the German standards body.The PS/2 port is a 6-pin mini-DIN connector used for connecting keyboards and mice to a PC compatible computer system. Its name comes from the IBM Personal System/2 series of personal computers, with which it was introduced in 1987.

6.WHAT IS USB INTERFACE ?

A Universal Serial Bus (USB) is a common interface that enables communication between devices and a host controller such as a personal computer (PC) or smartphone. It connects peripheral devices such as digital cameras, mice, keyboards, printers, scanners, media devices, external hard drives and flash drives. Because of its wide variety of uses, including support for electrical power, the USB has replaced a wide range of interfaces like the parallel and serial port.

7.TYPES OF USB INTERFACES ?

USB-A is most commonly used with computers or power outlets. When charging, you will connect the USB-A side into the USB-plug or into a laptop or computer.
USB-B ports are mostly used to connect printers or external hard drives with computers. They are not as common as the other types of USB cables. The USB-Mini was used for connecting mobile devices including MP3 players and cameras, and is a much smaller connection, thus allowing smaller devices to connect.
Micro-USB used to be the most common USB port and is still found on many older models. This type of connection allows data to be read without needing a computer. For example, you can connect Flash Drives, or Memory Sticks, directly to your mobile device.
USB-C is the most recent USB development and all new Samsung devices come with USB-C ports. USB-C cables allow high speed data transfers and a higher power flow, allowing your phone to charge more quickly. USB-C cables are also reversible and can be plugged in either way round.

USB 3 was designed to be able to be backwards compatible with earlier versions of USB cables and ports. The USB 3 has different shaped connector pins so it can withstand more frequent use.

8.WHAT IS SERIAL PORTS ?

An asynchronous port on the computer used to connect a serial device to the computer and capable of transmitting one bit at a time. Serial ports are usually identified on IBM compatible computers as COM (communications) ports. For example, a mouse might connect to COM1 and a modem to COM2. The picture shows the DB9 serial connector on a cable. The serial port is found on the back of the computer and is part of the motherboard.

9.WHAT IS PARALLEL PORTS ?

Less commonly referred to as the Centronics interface, Centronics connector, or Centronics port after the company that originally designed it, the port was later developed by Epson. The parallel port is found on the back of IBM compatible computers and is a 25-pin (type DB-25) computer interface commonly used to connect printers to the computer .The parallel port is found on the back of the computer and is part of the motherboard. Below is an example of the DB25 interface found on the back of the computer.

10.WHAT IS NIC NETWORK INTERFACE CARD RJ45 VS RJ11 ?

PARAMETER	RJ11	RJ45
Usage	RJ11 is the cable connector used in telephone sets, ADSL lines and modem cables etc.	RJ45 jacks are used in networking, where one connects computers or other network elements to each other.
Wires/Connectors	RJ11 is 4 slot connector	RJ45 is an eight slot connector
Wiring Standard	RJ11 is 4P4C wiring standard	RJ45 is an 8P8C wiring standard. This means that there are also 8

PARAMETER	RJ11	RJ45
	6P4C wiring standard which means it has 6 Positions with 4 Conductor.	wires that are terminated in the connector, occupying all the available slots.
Size	Smaller in size than RJ45	Bigger is size than RJ11
Bandwidth Supported	Can Support somewhere around 24 Mbps bandwidth (e.g. – ADSL+)	RJ45 on Cat7 and Cat6a can support upto 10Gbps speed over Ethernet

11.WHAT IS ESATA EXTERNAL SATA ?

eSATA is a SATA connector accessible from outside the computer, to provide a signal (but not power) connection for external storage devices.[3]

eSATAp combines the functionality of an eSATA and a USB port, and a source of power in a single connector. eSATAp can supply power at 5 V and 12 V.

12.WHAT IS VGA PORT ?

- The most common type of port was a VGA output, which allowed you to connect your analog computer monitor to other monitors or televisions. At the inception of HDTV, VGA was used in order to provide a higher quality picture through an HD15 connector. But as technology advanced, new solutions were created.The result was the HDMI port and cable, which allow for higher pixelation and better colorization. Most newer computers have HDMI components, but that doesn't mean that an older device or one created with VGA capabilities is obsolete. It's possible to connect your older computer to a newer display or additional device through the use of an HDMI to VGA adapter.

1. For gaming
2. For older displays
3. For older projectors and video editing

13.WHAT IS FIREWIRE PORT ?

Connect multiple types of devices that requires faster data transmission speed.FireWire, also called IEEE 1394 or i.LINK, high-speed computer data-transfer interface used to connect personal computers, audio and video devices, and other professional and consumer electronics. The American computer and electronics company Apple Inc. led the initiative for adoption of the Institute of Electrical and Electronics Engineers' Standard 1394 (IEEE 1394). Apple trademarked FireWire for its own use, and the Japanese electronics company Sony Corporation, another early developer of the standard, trademarked i.LINK for its products.

14.WHAT IS DVI (DIGITAL VISUAL INTERFACE) ?

DVI stands for "digital visual interface". DVI cables are most commonly used to transmit video data from older PCs to older monitors (HDMI cables are a more advanced replacement that transmit audio data as well as video, unlike DVI cables). Short for Digital Visual Interface, DVI is a video display interface. It was developed to be an industry standard for transmitting digital video content to display devices at resolutions as high as 2560 x 1600. Common devices that utilize the DVI connection are computer monitors and projectors.

15.WHAT IS HDMI HIGH DEFINATION MULTIMEDIA INTERFACE ?

The HDMI® specification is a connection method that combines both uncompressed audio and video into a single digital interface and is used for connecting various types of products. It supports both high-definition and standard-definition video and up to 8-channel digital audio.

EXPERIMENT – 2

AIM OF EXPERIMENT : To study about motherboard and its different parts.

HARDWARE REQUIREMENTS : Motherboard

Theory:

In personal computers, a motherboard is the central printed circuit board (PCB) in many modern computers and holds many of the crucial components of the system, providing connectors for other peripherals.

Overview:

A motherboard, like a backplane, provides the electrical connections by which the other components of the system communicate, but unlike a backplane, it also connects the central processing unit and hosts other subsystems and devices.

An important component of a motherboard is the microprocessor's supporting chipset, which provides the supporting interfaces between the CPU and the various buses and external components. This chipset determines, to an extent, the features and capabilities of the motherboard.

Modern motherboards include, at a minimum:

- sockets(or slots) in which one or more microprocessors may be installed slots into which the system's main memory is to be installed (typically in the form of DIMM modules containing DRAM chips
- a chipset which forms an interface between the CPU's front-side bus, main memory, and peripheral buses non-volatile memory chips (usually flash rom in modern motherboards) containing the system's firmware.
- A clock generator which produces the system clock signal to synchronize the various component
- slots for expansion cards (these interface to the system via the buses supported by the chipset
- Power connectors, which receive electrical power from the computer power supply and distribute it to the CPU, chipset, main memory, and expansion cards.

CPU sockets:

A CPU socket or slot is an electrical component that attaches to a printed circuit board (PCB) and is designed to house a CPU .It is a special type of integrated circuit socket. A CPU socket provides the physical structure to support the CPU , support for heat sink and many other things.

With the steadily declining costs and size of integrated circuits, it is now possible to include support for many peripherals on the motherboard. By combining many functions on one PCB, the physical size and total cost of the system may be reduced; highly integrated motherboards are thus especially popular in small form factor and budget computers.

Peripheral card slots

A standard ATX motherboard will typically have one PCI-E 16x connection for a graphics card, two conventional PCI slots for various expansion cards, and one PCI-E 1x (which will eventually supersede PCI). A standard EATX motherboard will have one PCI-E 16x connection for a graphics card, and a varying number of PCI and PCI-E 1x slots.

A sound chip is always included on the motherboard, to allow sound output without the need for any extra components. This allows computers to be far more multimedia-based than before.

Temperature and reliability

Motherboards are generally air cooled with heat sinks often mounted on larger chips, such as the Northbridge, in modern motherboards. If the motherboard is not cooled properly, it can cause the computer to crash.Passive cooling, or a single fan mounted on the power supply, was sufficient for many desktop computer CPUs until the late 1990s

EXPERIMENT – 3

AIM OF EXPERIMENT - To study about SMPS and its parts .

HARDWIRE REQUIREMENTS – SMPS

THEORY :

A switched-mode power supply (SMPS) is an electronic circuit that converts power using switching devices that are turned on and off at high frequencies, and storage components such as inductors or capacitors to supply power when the switching device is in its non-conduction state.
Switching power supplies have high efficiency and are widely used in a variety of electronic equipment, including computers and other sensitive equipment requiring stable and efficient power supply.
A switched-mode power supply is also known as a switch-mode power supply or switching-mode power supply.
Switched-mode power supplies are classified according to the type of input and output voltages. The four major categories are:

- AC to DC
- DC to DC
- DC to AC
- AC to AC

A basic isolated AC to DC switched-mode power supply consists of:

- Input rectifier and filter
- Inverter consisting of switching devices such as MOSFETs
- Transformer
- Output rectifier and filter
- Feedback and control circuit

The input DC supply from a rectifier or battery is fed to the inverter where it is turned on and off at high frequencies of between 20 KHz and 200 KHz by the switching MOSFET or power transistors. The high-frequency voltage pulses from the inverter are fed to the transformer primary winding, and the secondary AC output is rectified and smoothed to produce the required DC voltages. A feedback circuit monitors the output voltage and instructs the control circuit to adjust the duty cycle to maintain the output at the desired level.

There are different circuit configurations known as topologies, each having unique characteristics, advantages and modes of operation, which determines how the input power is transferred to the output.

Most of the commonly used topologies such as flyback, push-pull, half bridge and full bridge, consist of a transformer to provide isolation, voltage scaling, and multiple output voltages. The non-isolated configurations do not have a transformer and the power conversion is provided by the inductive energy transfer.

Advantages of switched-mode power supplies:

- Higher efficiency of 68% to 90%
- Regulated and reliable outputs regardless of variations in input supply voltage
- Small size and lighter
- Flexible technology
- High power density

Disadvantages:

- Generates electromagnetic interference
- Complex circuit design
- Expensive compared to linear supplies

Switched-mode power supplies are used to power a wide variety of equipment such as computers, sensitive electronics, battery-operated devices and other equipment requiring high efficiency.

EXPERIMENT – 4

AIM OF EXPERIMENT : To study about different parts of mouse and keyboards

HARDWARE REQUIRED : A PS2 Mouse (Trainer Kit Sigma)

THEORY :

In computing, a mouse is a pointing device that functions by detecting two-dimensional motion relative to its supporting surface. Physically, a mouse consists of an object held under one of the user's hands, with one or more buttons. It sometimes features other elements, such as "wheels", which allow the user to perform various system-dependent operations, or extra buttons or features that can add more control or dimensional input. The mouse's motion typically translates into the motion of a cursor on a display, which allows for fine control of a graphical user interface.

Explanation:

Naming

The first known publication of the term "*mouse*" as a pointing device is in Bill English's 1965 publication "Computer-Aided Display Control".The online *Oxford Dictionaries* entry for mouse states the plural for the small rodent is mice, while the plural for the small computer connected device is either mice or mouses. However, in the usage section of the entry it states that the more common plural is mice.

Variants

Mechanical mice

The ball-mouse replaced the external wheels with a single ball that could rotate in any direction. It came as part of the hardware package of the Xerox Alto computer. Perpendicular chopper wheels housed inside the mouse's
body chopped beams of light on the way to light sensors, thus detecting in their turn the motion of the ball.

Optical and Laser mice

Optical mice make use of one or more light-emitting diodes (LEDs) and an imaging array of photodiodes to detect movement relative to the underlying surface, rather than internal moving parts as does a mechanical mouse. A Laser mouse is an optical mouse that uses coherent (Laser) light.

3D mice

Also known as bats, flying mice, or wands, these devices generally function through ultrasound and provide at least three degrees of freedom. Probably the best known example would be 3DConnexion/Logitech's SpaceMouse from the early 1990s.

In the late 1990s Kantek introduced the 3D RingMouse. This wireless mouse was worn on a ring around a finger, which enabled the thumb to access three buttons. The mouse was tracked in three dimensions by a base station

Connectivity and communication protocols

Serial interface and protocol

Standard PC mice once used the RS-232C serial port via a D-subminiature connector, which provided power to run the mouse's circuits as well as data on mouse movements. The Mouse Systems Corporation version used a five-byte protocol and supported three buttons

PS/2 interface and protocol

With the arrival of the IBM PS/2 personal-computer series in 1987, IBM introduced the eponymous PS/2 interface for mice and keyboards, which other manufacturers rapidly adopted.

Operation

A mouse typically controls the motion of a cursor in two dimensions in a graphical user interface (GUI). Clicking or hovering (stopping movement while the cursor is within the bounds of an area) can select files, programs or actions from a list of names, or (in graphical interfaces) through small images called "icons" and other elements. For example, a text file might be represented by a picture of a paper notebook, and clicking while the cursor hovers this icon might cause a text editing program to open the file in a window.

Buttons

The three-button scroll mouse has become the most commonly available design. As of 2007 (and roughly since the late 1990s), users most commonly employ the second button to invoke a contextual menu in the computer's software user interface, which contains options specifically tailored to the interface element over which the mouse cursor currently sits.

Mouse speed

The computer industry often measures mouse sensitivity in terms of counts per inch (CPI), commonly expressed incorrectly as dots per inch (DPI) – the number of steps the mouse will report when it moves one inch. In early mice, this specification was called pulses per inch (ppi). If the default mouse-tracking condition involves moving the cursor by one screen-pixel or dot on-screen per reported step, then the CPI does equate to DPI: dots of cursor motion per inch of mouse motion.

Hardware Requirement:
Key Board (Trainer Kit Sigma)

Theory:
In computing, a keyboard is a typewriter-style keyboard, which uses an arrangement of buttons or keys, to act as mechanical levers or electronic switches. Following the decline of punch cards and paper tape, interaction via teletype-style keyboards became the main input device for computers.
In normal usage, the keyboard is used to type text and numbers into a word processor or other program. In a modern computer, the interpretation of key presses is generally left to the software. A computer keyboard distinguishes each physical key from every other and reports all key presses to the controlling software.

Explanation:

Keyboard types

One factor determining the size of a keyboard is the presence of duplicate keys, such as a separate numeric keyboard, for convenience.
Further the keyboard size depends on the extent to which a system is used where a single action is produced by a combination of subsequent or simultaneous keystrokes (with modifier keys, see below), or multiple pressing of a single key. A keyboard with few keys is called a keypad. See also text entry interface.

Non-standard layout and special-use types

Chorded

While other keyboards generally associate one action with each key,Chorded keyboards associate actions with combinations of key presses. Since there are many combinations available, chorded keyboards can effectively produce more actions on a board with fewer keys.

Software

Software keyboards or on-screen keyboards often take the form of computer programs that display an image of a keyboard on the screen. Another input device such as a mouse or a touchscreen can be used to operate each virtual key to enter text. Software keyboards have become very popular in touchscreen enabled cell phones.

Foldable

Foldable (also called flexible) keyboards are made of soft plastic which can be rolled or folded on itself for travel.[3] When in use, these keyboards can conform to uneven surfaces, and are more resistant to liquids than standard keyboards.

Projection/laser

Projection keyboard projects an image of keys, usually with a laser, onto a flat surface. The device then uses a camera or infrared sensor to "watch" where the user's fingers move, and will count a key as being pressed when it "sees" the user's finger touch the projected image.

Technology

Control processor

Computer keyboards include control circuitry to convert key presses into key codes that the computer's electronics can understand. The key switches are connected via the printed circuit board in an electrical X-Y matrix where a voltage is provided sequentially to the Y lines and, when a key is depressed, detected sequentially by scanning the X lines.

Connection types

There are several ways of connecting a keyboard to a system unit using cables, including the standard AT connector commonly found on motherboards, which was eventually replaced by the and the USB connection

EXPERIMENT – 5

AIM OF EXPERIMENTS : To study about HDD and its parts.

HARDWARE RIQUIRED : HDD

THEORY:

A hard disk drive (HDD; also hard drive or hard disk) is a non-volatile, random access digital data storage device. It features rotating rigid platters on a motor-driven spindle within a protective enclosure. Data is magnetically read from and written to the platter by read/write heads that float on a film of air above the platters.

EXPLANATION:

HDDs record data by magnetizing ferromagnetic material directionally. Sequential changes in the direction of magnetization represent patterns of binary data bits. The data are read from the disk by detecting the transitions in magnetization and decoding the originally written data. Different encoding schemes, such as Modified Frequency Modulation, group code recording, run-length limited encoding, and others are used.

Five Main Components

Platters - The aluminum alloy disks upon which data is stored. It's a magnetic media, somewhat akin to the surface preparation on a cassette tape. However, the surface of the platter is magnetically formatted (on both sides) into **sectors** and **tracks** where digital information is written.

Spindle - the platters or disks spin on the spindle, which is run by a motor on the drive. we could say it's kind of like the axle on a wheel.

Read/Write Heads - The heads move across the platters to write data to, and read data from the platters. There's a read/write head for each side of each platter. Access is random, meaning that the heads can jump straight to the information they want without having to fast-forward or rewind past unneeded information.

Head Actuator - Controls the read/write heads. The heads are at the end of an actuator arm which is attached to the actuator.

Circuit board - Receives commands from the **hard drive controller** and translates them in order to move the head actuator, which moves the read/write head across the platters to the required position.

Translation

For your BIOS to recognize your hard drive properly, it needs to know the number of cylinders on each platter, the number of heads, and the number of sectors/track.

cylinders x heads x sectors per track x 512(bits per sector) = capacity

If you look at the list of drive types in your BIOS you'll see that the largest is about 132 MB. I know it's important to stay backward compatible, but surely they could get rid of the first 46 HD choices. The 'user defined' (usually 47 or 48) type allows you to enter configuration for drives larger than this.

Performance characteristics

o Access time

The factors that limit the time to access the data on a hard disk drive (Access time) are mostly related to the mechanical nature of the rotating disks and moving heads. Seek time is a measure of how long it takes the head assembly to travel to the track of the disk that contains data. Rotational latency is incurred because the desired disk sector may not be directly under the head when data transfer is requested

o Interleave

A low-level formatting tool running tests to find the highest performance interleave choice for a 10-megabyte IBM PC XT hard drive.

Sector interleave is a mostly obsolete device characteristic related to access time, dating back to when computers were too slow to be able to read large continuous streams of data. Interleaving introduced gaps between data sectors to allow time for slow equipment to get ready to read the next block of data.

o Data transfer rate

As of 2010, a typical 7200 rpm desktop hard drive has a sustained "disk-to-buffer" data transfer rate up to 1030 Mbits/sec. This rate depends on the track location, so it will be higher for data on the outer tracks (where there are more data sectors) and lower toward the inner tracks (where there are fewer data sectors); and is generally somewhat higher for 10,000 rpm drives

o Power consumption

Power consumption has become increasingly important, not only in mobile devices such as laptops but also in server and desktop markets. Increasing data center machine density has led to problems delivering sufficient power to devices (especially for spin up), and getting rid of the waste heat subsequently produced, as well as environmental and electrical cost concerns (see green computing).

Maintenance

- Be aware of file management and organization.
- Maintain a regular schedule of deleting .TMP, .CHK, .$$$, BAK files and temporary internet files, as well as removing unwanted programs and files.
- Use a scanning utility to check for, and repair, cross-linked files, lost clusters or bad sectors on a monthly basis. Microsoft provides a utility called Scandisk with DOS and Windows that does a good job of this. Just type SCANDISK at the DOS prompt, or choose it from the System Tools section in Windows95/98/2000
- Defragment your hard drive periodically. As programs and files are removed from your hard drive and new ones added, they become defragmented, spread out on your hard drive in non-contiguous sectors. You may notice a decrease in the hard drive's performance, as the read/write heads have to jump all over the place trying to piece together files that are in scattered sectors. Again, your operating system may provide the answer. You can type DEFRAG at the DOS prompt, or choose Disk Defragmenter from System Tools.
- Always keep a copy of your drive settings from CMOS (its good to make a copy of all your CMOS settings).Develop a system of boot disks or recovery disks.
- Be careful of bumps, kicks, jolts and shakes. Remember the heads are very close to the disk surface, and if they touch (head crash) they can damage those sectors.

EXPERIMENT- 6

AIM OF EXPERIMENT - To study about dot matrix printer

HARDWARE REQUIRED – dot matrix printer

THEORY

The term dot matrix refers to the process of placing dots to form an image, the quality of the image being determined by the dots per inch (dpi). A dot matrix printer is a type of printer with a print head that runs to and fro, or up and down, on the page and prints by striking an ink-soaked ribbon against the paper. Dot-matrix printers are relatively expensive and do not produce high-quality output. Quality of output is poor because characters are formed by dots. Printing speed ranges from 180cps to, 240cps, 260cps, 300cps and360 cps.

Dot matrix printers print columns of dots in a serial fashion. The more dot hammers (pins), the better looking the printed results. The print head can get very hot.

A dot matrix printer (DMP) is a type of printer which uses pins impacting an ink ribbon to print. These printers are generally considered outdated, as they cannot create high-quality prints and are costly as well. However, they have a certain specialty that other printers like inkjet and laser printers do not have: as they use impact for printing, they can be used to print multiple copies of text at the same time with the help of carbon copying. Therefore, they are mostly used in places where multipart forms are required.

A dot matrix printer is also known as an impact matrix printer.

In a dot matrix printer, the characters and letters are formed by a matrix of dots. A print head, which has many pins in it, moves in the required direction and strikes against a cloth ribbon which is soaked in ink, making a mark on the paper. The dots are spaced closely in a particular shape to make the intended character. This looks quite similar to the printing mechanism of typewriters and daisy wheel printers. However, dot matrix printers are different in the sense that many different characters and graphics can be printed. A character printed by a DMP is actually an accumulation of many such dots on a small area of the paper.

EXPERIMENT - 7

AIM OF THE EXPERIMENT: To design 1-bit ALU using MUX , logic gates and adder circuit and design a 4-bit ALU using 1-bit ALU and design a 8-bit ALU using a 4-bit ALU .

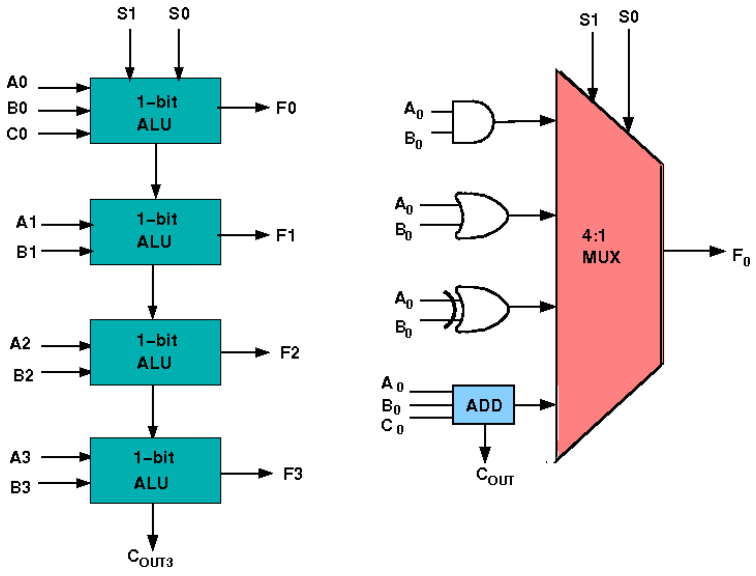
HARDWARE REQUIREMENTS: Printed board , 4-bit register, Flag register ,Program counter register (PC), Memory address register (MAR), Instruction register (IR), and Buffer Register. AND gate, OR gate, XOR gate,Full Adder,4-to-1 MUX< , Wires to connect.

THEORY:

An **arithmetic logic unit (ALU)** is a digital circuit used to perform arithmetic and logic operations. It represents the fundamental building block of the **central processing unit (CPU)** of a computer. Modern CPUs contain very powerful and complex ALUs. In addition to ALUs, modern CPUs contain a control unit (CU).

Design of ALU

ALU or Arithmetic Logical Unit is a digital circuit to do arithmetic operations like addition, subtraction,division, multiplication and logical oparations like and, or, xor, nand, nor etc. A simple block diagram of a 4 bit ALU for operations and,or,xor and Add is shown here :



The 4-bit ALU block is combined using 4 1-bit ALU block

Design Issues :

The circuit functionality of a 1 bit ALU is shown here, depending upon the control signal S_1 and S_0 the circuit operates as follows:

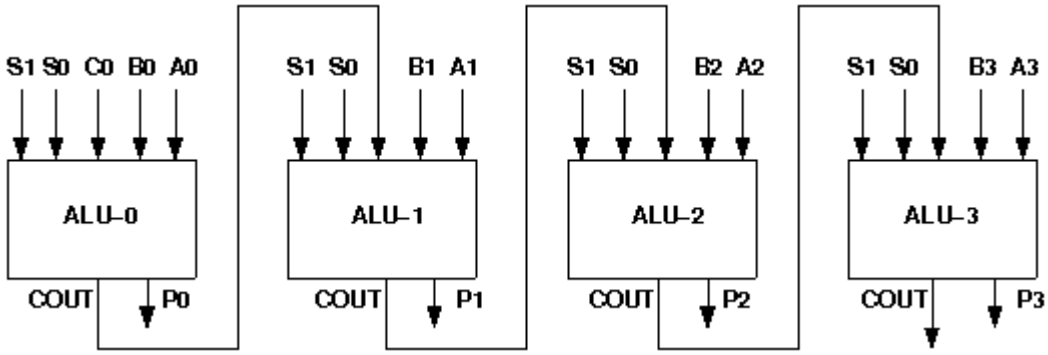
for Control signal $\mathbf{S_1 = 0}$, $S_0 = 0$, the output is **A And B**,

for Control signal $\mathbf{S_1 = 0}$, $S_0 = 1$, the output is **A Or B**,

for Control signal $\mathbf{S_1 = 1}$, $S_0 = 0$, the output is **A Xor B**,

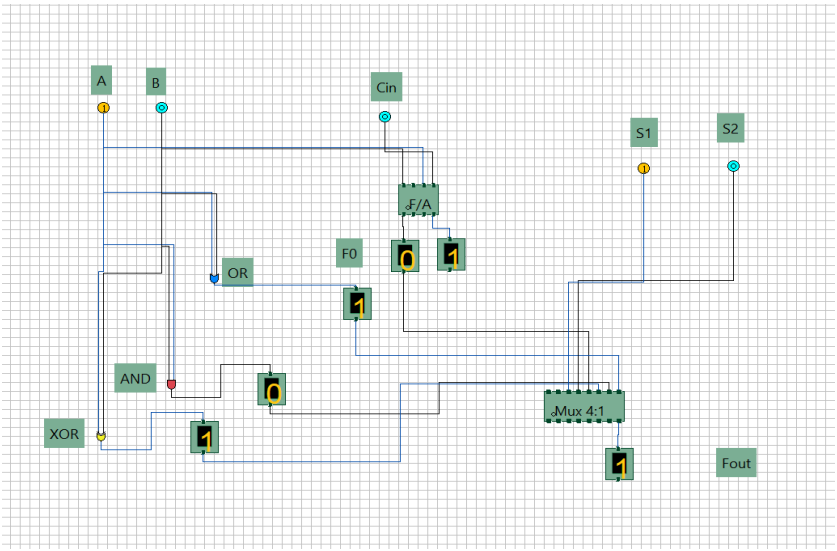
for Control signal $\mathbf{S_1 = 1}$, $S_0 = 1$, the output is **A Add B**.

Circuit diagram of 4 bit ALU:

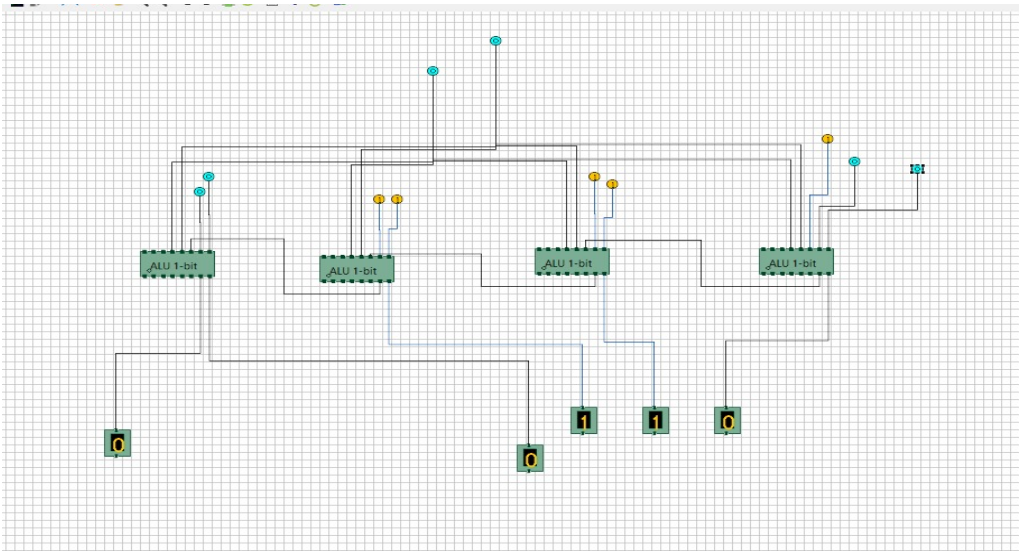


OUTPUT:

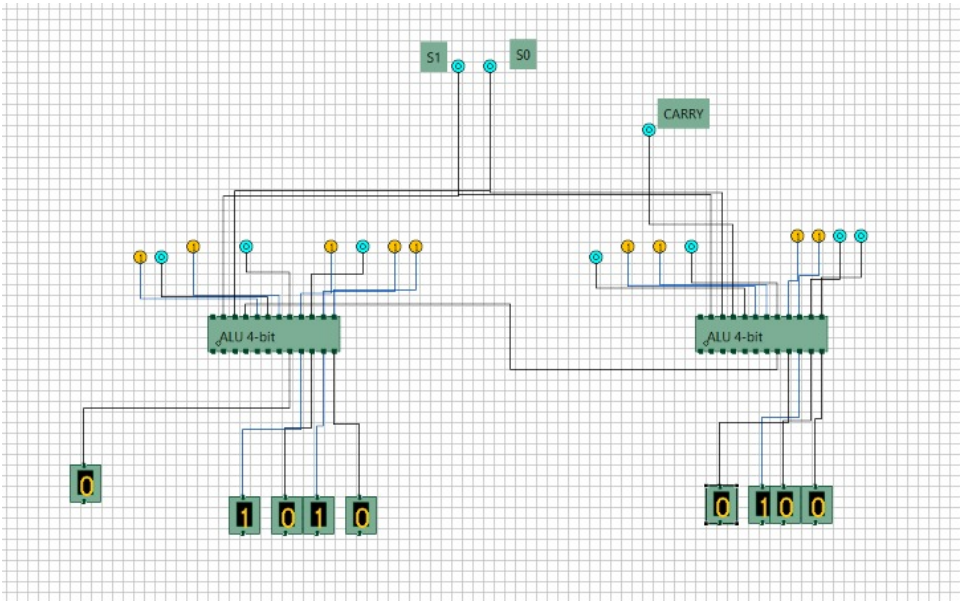
DESIGN 1-BIT ALU



DESIGN 4-BIT ALU



DESIGN 8-BIT ALU



CONCLUSION

Design and implementation of ALU was done successfully.

EXPERIMENT – 8

AIM OF EXPERIMENT

1.Design a binary RAM cell using a S-R flipflop, AND gates, NOT gates having select, read/write, input, output and test it by giving proper input.

2.Design a 4X4 RAM memory which will have 4 words each of 4 bits using binary RAM cells, decoder with enable, OR gates and test it by giving proper input.

THEORY

RAM (Random Access Memory) is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. Hence, a backup Uninterruptible Power System (UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold.

RAM is of two types −

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

Static RAM (SRAM)

The word **static** indicates that the memory retains its contents as long as power is being supplied. However, data is lost when the power gets down due to volatile nature. SRAM chips use a matrix of 6-transistors and no capacitors. Transistors do not require power to prevent leakage, so SRAM need not be refreshed on a regular basis.

There is extra space in the matrix, hence SRAM uses more chips than DRAM for the same amount of storage space, making the manufacturing costs higher. SRAM is thus used as cache memory and has very fast access.

Characteristic of Static RAM

- Long life
- No need to refresh
- Faster
- Used as cache memory
- Large size
- Expensive
- High power consumption

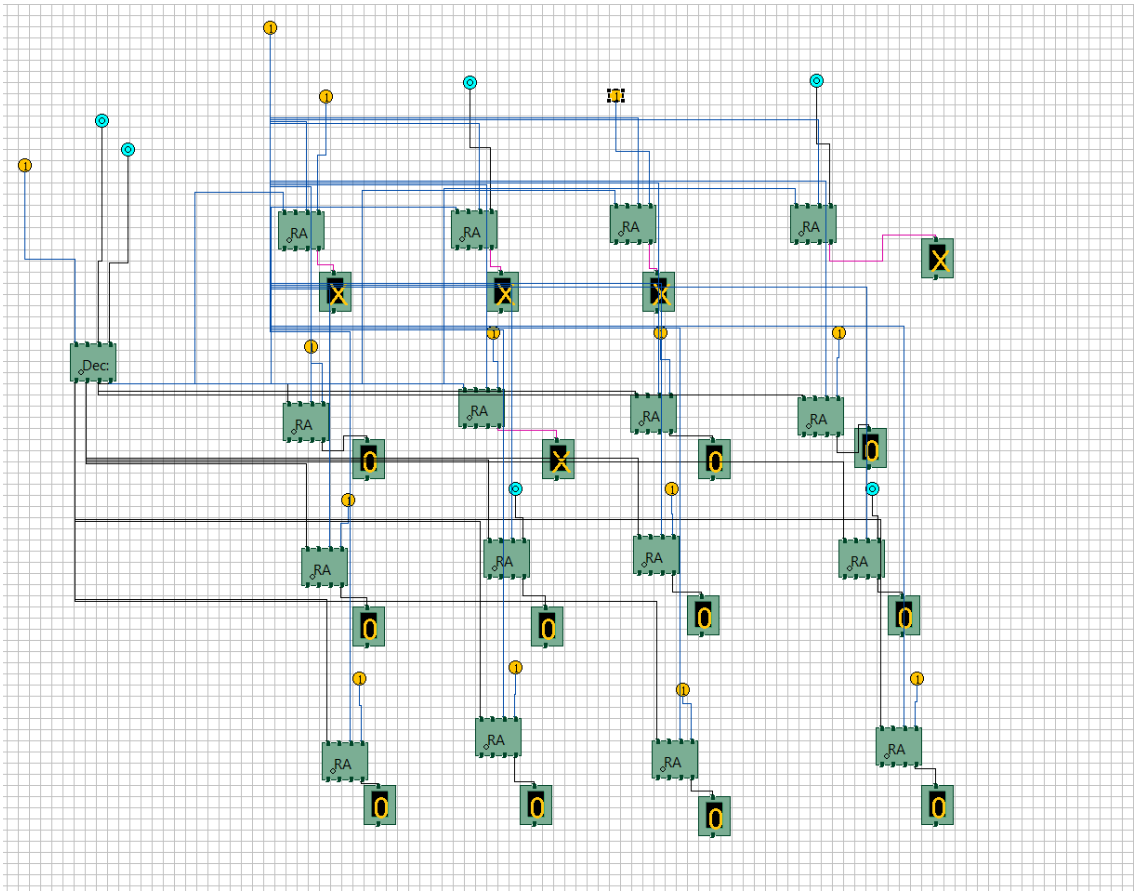
Dynamic RAM (DRAM)

DRAM, unlike SRAM, must be continually **refreshed** in order to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory as it is cheap and small. All DRAMs are made up of memory cells, which are composed of one capacitor and one transistor.

Characteristics of Dynamic RAM

- Short data lifetime
- Needs to be refreshed continuously
- Slower as compared to SRAM
- Used as RAM
- Smaller in size
- Less expensive
- Less power consumption

OUTPUT



EXPERIMENT – 9

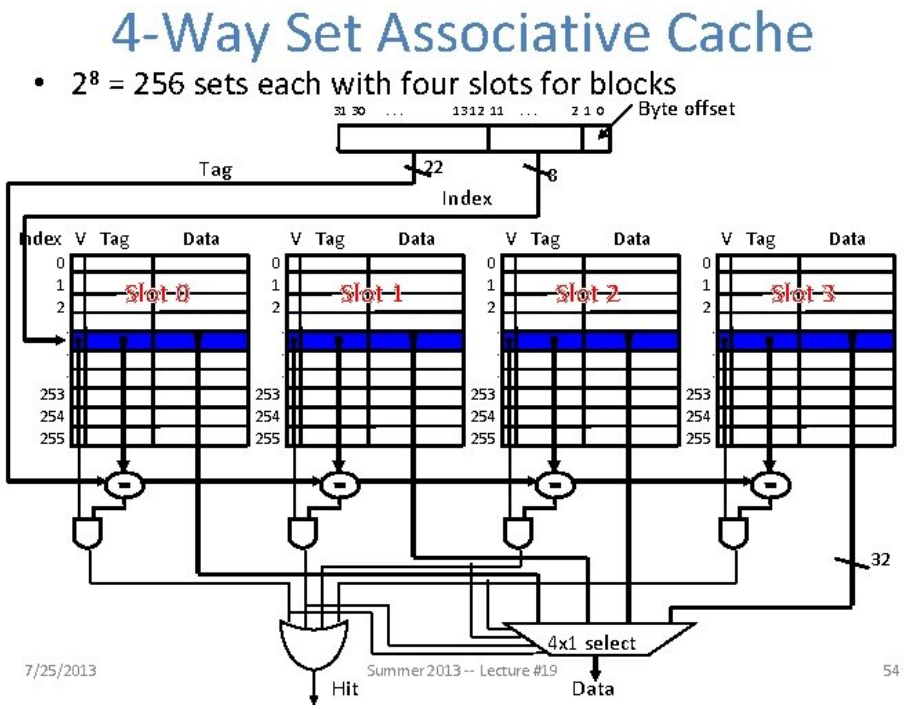
AIM OF EXPERIMENT - Design a Fully Associative Cache Memory with tag size 8 bit and data size 8 bit.

THEORY :

In set associative mapping,

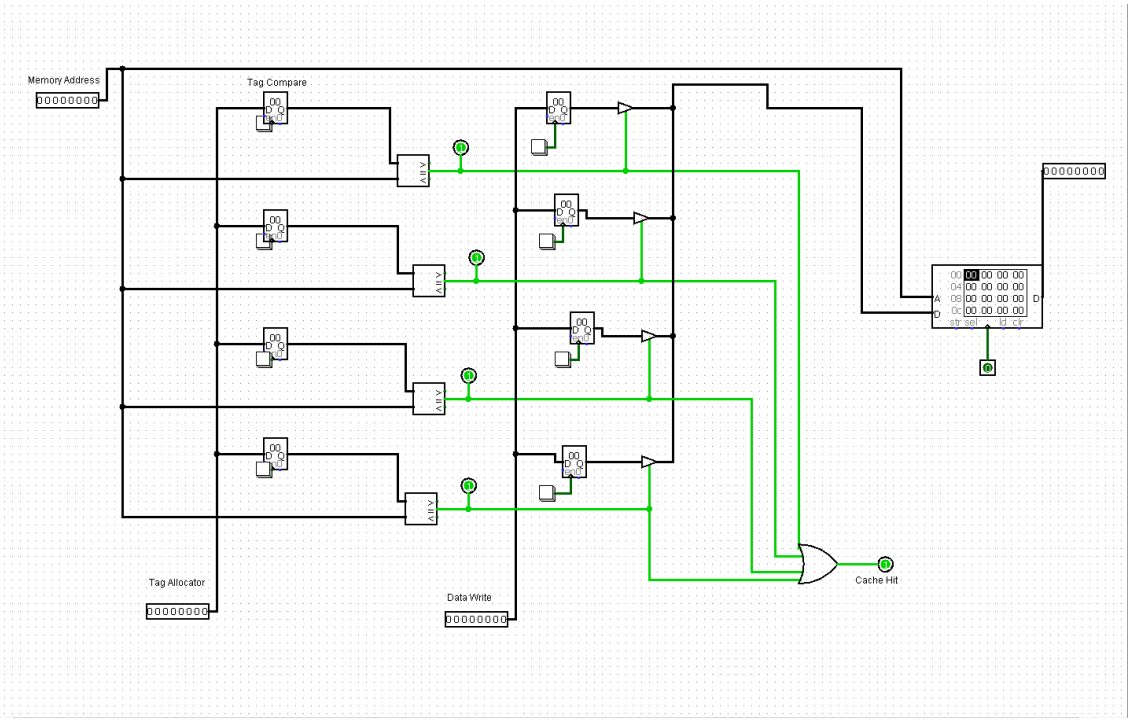
- A particular block of main memory can be mapped to one particular cache set only.
- Block 'j' of main memory will map to set number (j mod number of sets in cache) of the cache.
- A replacement algorithm is needed if the cache is full.

A fully associative cache contains a single set with B ways, where B is the number of blocks. A memory address can map to a block in any of these ways. A fully associative cache is another name for a B-way set associative cache with one set.



A fully associative cache permits data to be stored in any cache block, instead of forcing each memory address into one particular block.
— When data is fetched from memory, it can be placed in any unused block of the cache.
— This way we'll never have a conflict between two or more memory addresses which map to a single cache block.
 An intermediate possibility is a set-associative cache.
— The cache is divided into groups of blocks, called sets.
— Each memory address maps to exactly one set in the cache, but data may be placed in any block within that set.
 If each set has 2x blocks, the cache is an 2
x
-way associative cache.
 Here are several possible organizations of an eight-block cache.

OUTPUT



EXPERIMENT – 10

AIM OF EXPERIMENT – Design 4-bit Shift Registers (SISO, SIPO, PISO, PIPO)

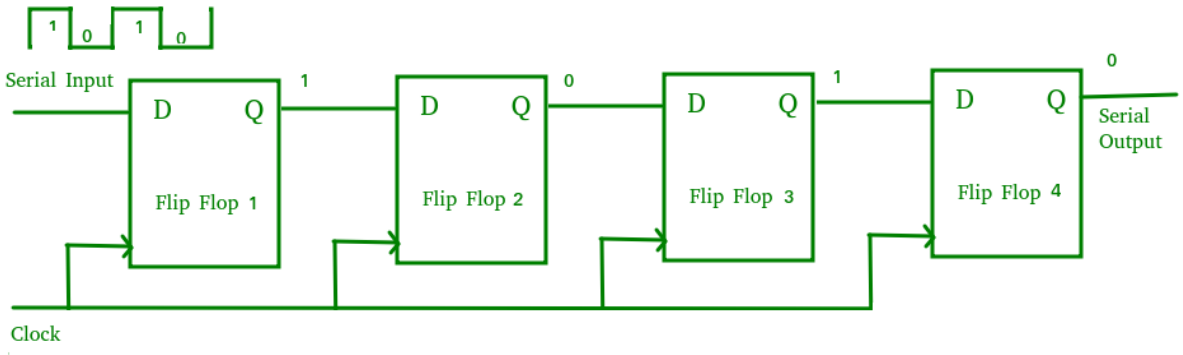
THEORY

Flip flops can be used to store a single bit of binary data (1or 0). However, in order to store multiple bits of data, we need multiple flip flops. N flip flops are to be connected in an order to store n bits of data. A Register is a device which is used to store such information. It is a group of flip flops connected in series used to store multiple bits of data. The information stored within these registers can be transferred with the help of shift registers. Shift Register is a group of flip flops used to store multiple bits of data. The bits stored in such registers can be made to move within the registers and in/out of the registers by applying clock pulses.
Shift registers are basically of 4 types. These are:

- Serial In Serial Out shift register
- Serial In parallel Out shift register
- Parallel In Serial Out shift register
- Parallel In parallel Out shift register

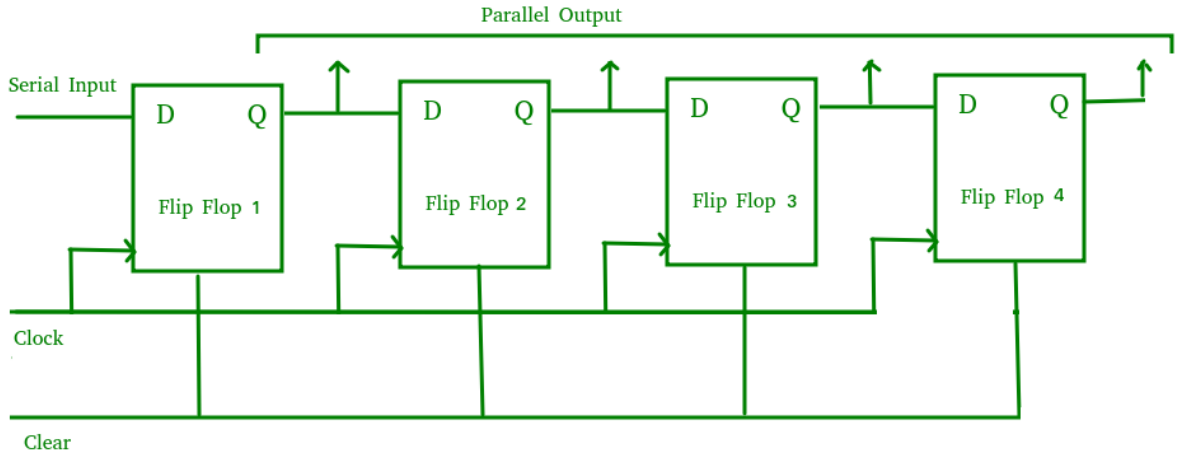
Serial-In Serial-Out Shift Register (SISO) –

The shift register, which allows serial input (one bit after the other through a single data line) and produces a serial output is known as Serial-In Serial-Out shift register. Since there is only one output, the data leaves the shift register one bit at a time in a serial pattern, thus the name Serial-In Serial-Out Shift Register.



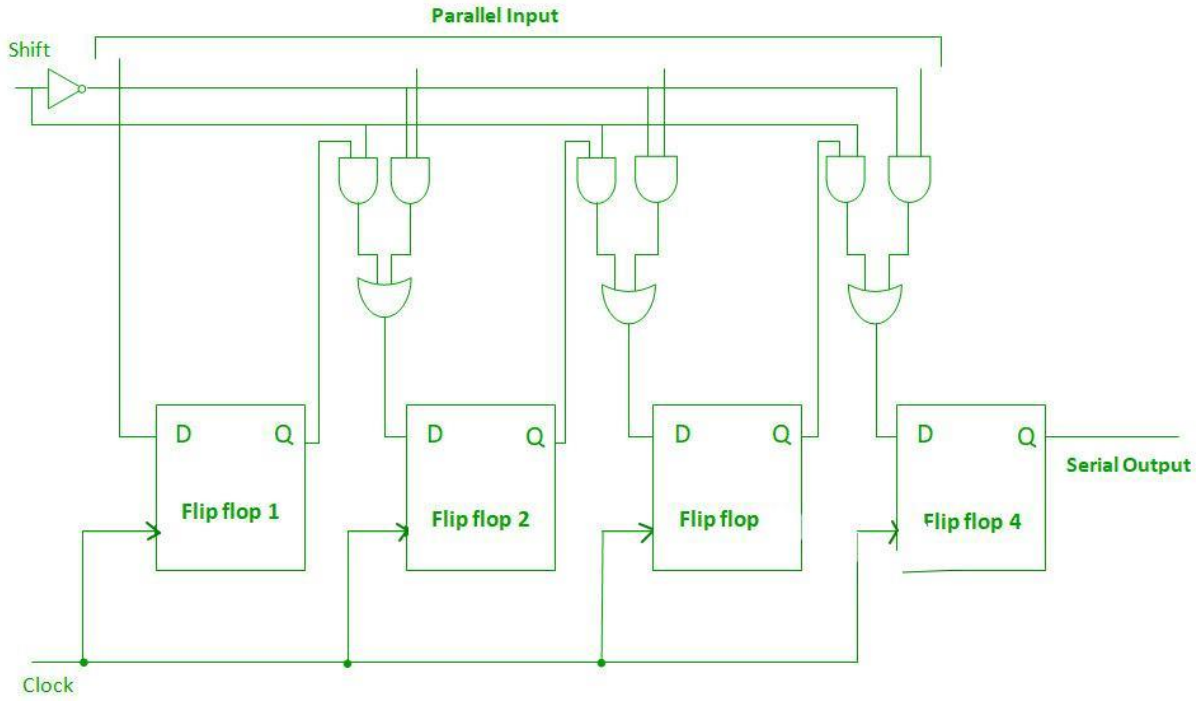
Serial-In Parallel-Out shift Register (SIPO) –

The shift register, which allows serial input (one bit after the other through a single data line) and produces a parallel output is known as Serial-In Parallel-Out shift register.



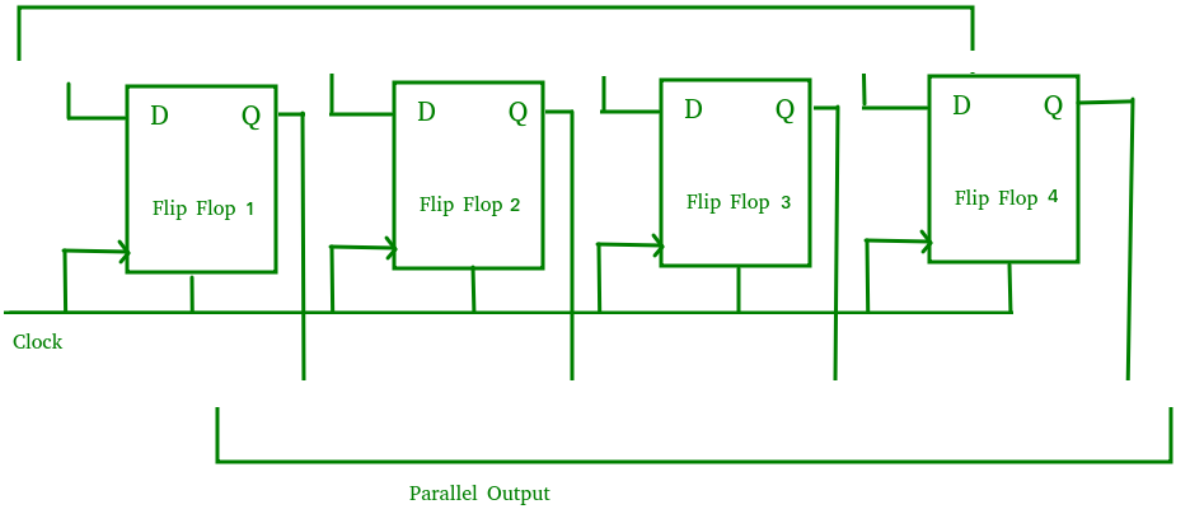
Parallel-In Serial-Out Shift Register (PISO) –

The shift register, which allows parallel input (data is given separately to each flip flop and in a simultaneous manner) and produces a serial output is known as Parallel-In Serial-Out shift register.

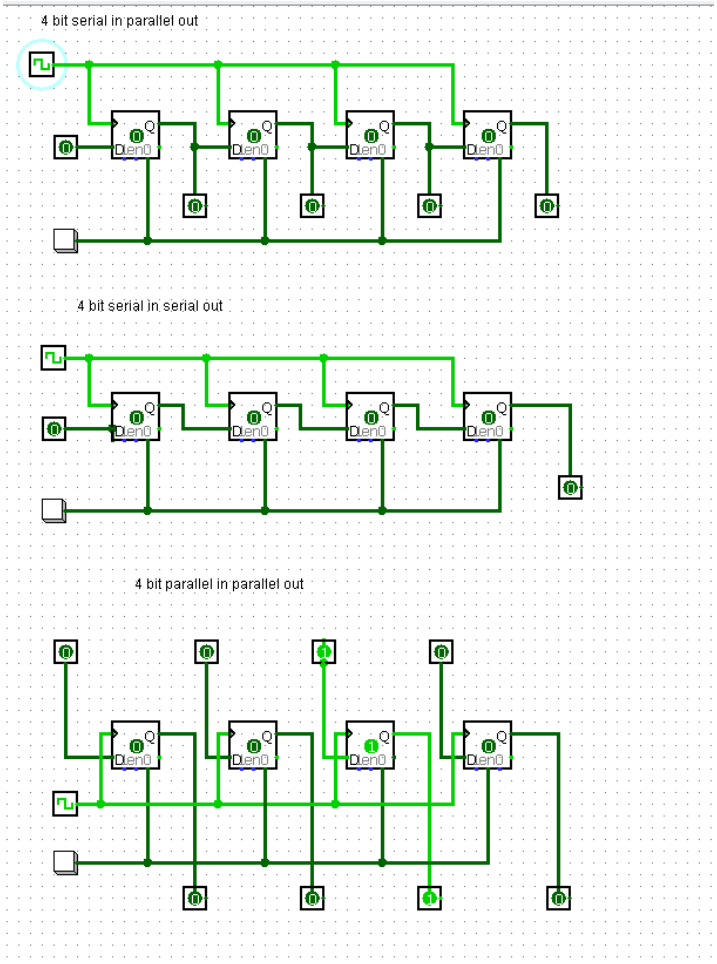


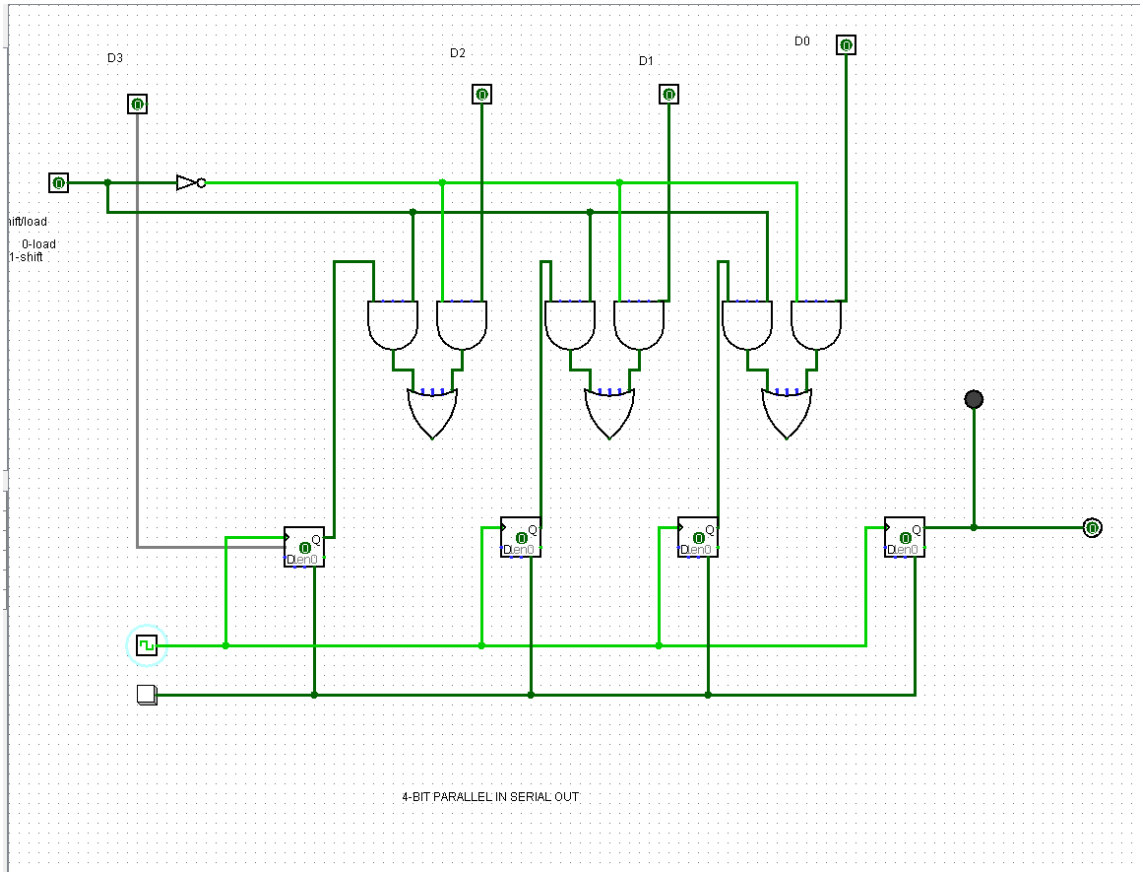
Parallel-In Parallel-Out Shift Register (PIPO) –

The shift register, which allows parallel input (data is given separately to each flip flop and in a simultaneous manner) and also produces a parallel output is known as Parallel-In parallel-Out shift register.



OUTPUT




D3
D2
D1
D0
ift/load
0-load
1-shift
Q
Den0
4-BIT PARALLEL IN SERIAL OUT

EXPERIMENT – 11

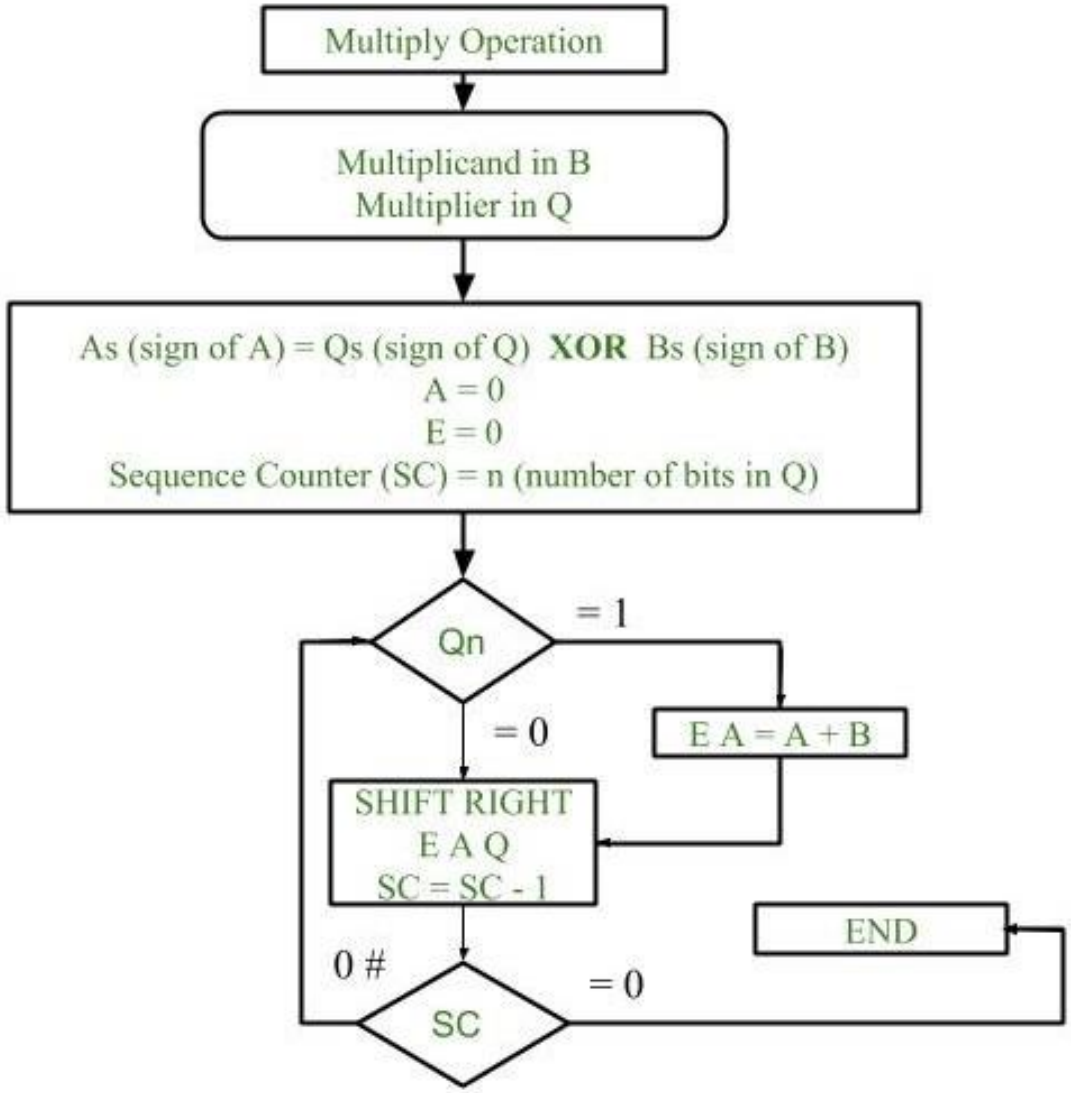
AIM OF EXPERIMENT – Design a hardware circuit for multiplication of two signed magnitude numbers (4 bit).

THEORY –

- Multiplication of two fixed point binary number in signed magnitude representation is done with process of successive shift and add operation.

```
   10111 (Multiplicand)
x  10011 (Multiplier)
  ------
   10111
   10111
  00000
 00000
10111
---------
011011010   (Product)
---------
```

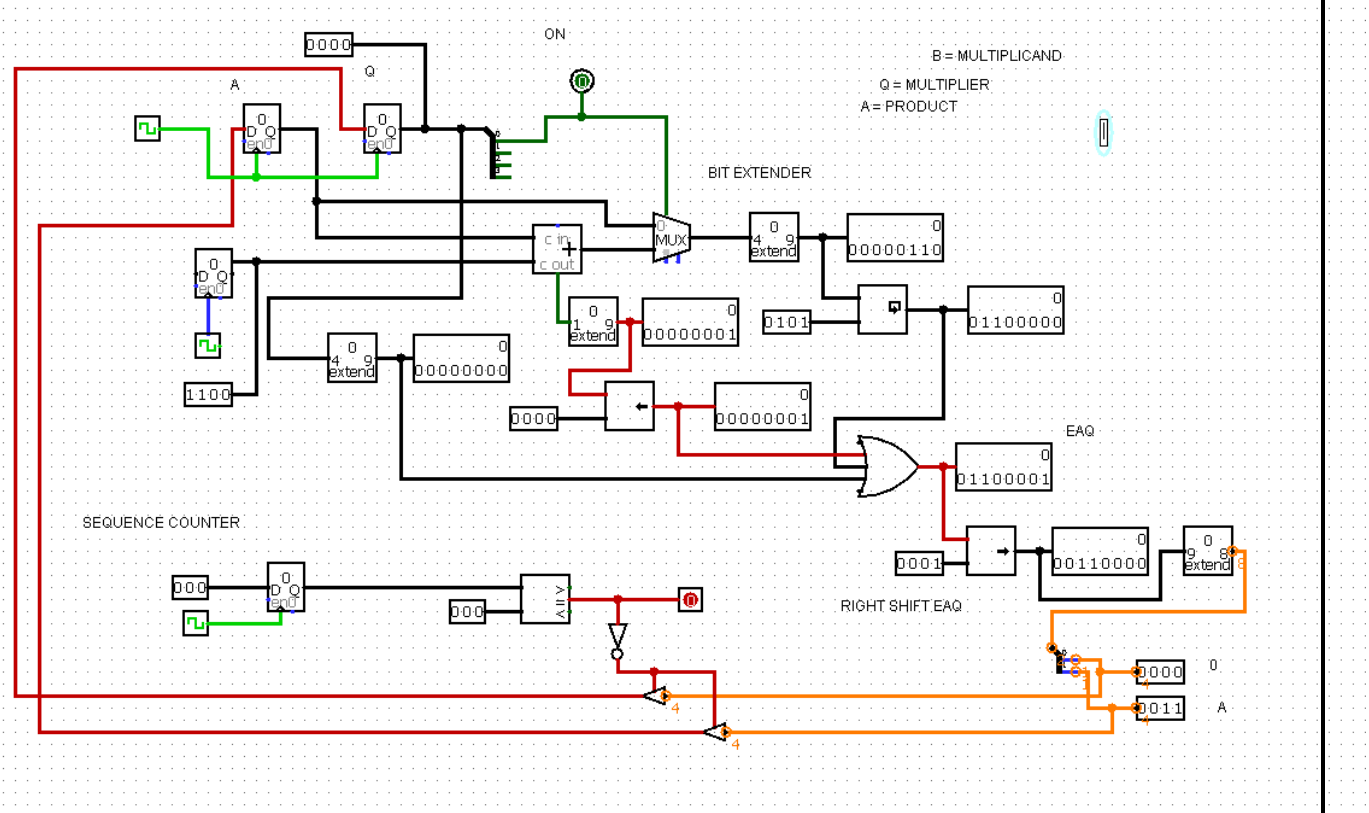
- Attention reader! Don't stop learning now. Get hold of all the important CS Theory concepts for SDE interviews with the CS Theory Course at a student-friendly price and become industry ready.
- In the multiplication process we are considering successive bits of the multiplier, least significant bit first.
- If the multiplier bit is 1, the multiplicand is copied down else 0's are copied down.
- The numbers copied down in successive lines are shifted one position to the left from the previous number.
- Finally numbers are added and their sum form the product.
- The sign of the product is determined from the sign of the multiplicand and multiplier. If they are alike, sign of the product is positive else negative.



1. Initially multiplicand is stored in B register and multiplier is stored in Q register.
2. Sign of registers B (Bs) and Q (Qs) are compared using XOR functionality (i.e., if both the signs are alike, output of XOR operation is 0 unless 1) and output stored in As (sign of A register).
3. Note: Initially 0 is assigned to register A and E flip flop. Sequence counter is initialized with value n, n is the number of bits in the Multiplier.
4. Now least significant bit of multiplier is checked. If it is 1 add the content of register A with Multiplicand (register B) and result is assigned in A register with carry bit in flip flop E. Content of E A Q is shifted to right by one position, i.e., content of E is shifted to **most** significant bit (MSB) of A and least significant bit of A is shifted to most significant bit of Q.
5. If Qn = 0, only shift right operation on content of E A Q is performed in a similar fashion.
6. Content of Sequence counter is decremented by 1.

7. Check the content of Sequence counter (SC), if it is 0, end the process and the final product is present in register A and Q, else repeat the process.

OUTPUT



EXPERIMENT – 12

AIM OF EXPERIMENT – Design a hardware circuit for multiplication two signed numbers using Booth's algorithm.

THEORY

- Booth algorithm gives a procedure for multiplying binary integers in signed 2's complement representation in efficient way, i.e., less number of additions/subtractions required. It operates on the fact that strings of 0's in the multiplier require no addition but just shifting and a string of 1's in the multiplier from bit weight 2^k to weight 2^m can be treated as 2^(k+1) to 2^m.
- As in all multiplication schemes, booth algorithm requires examination of the multiplier bits and shifting of the partial product. Prior to the shifting, the multiplicand may be added to the partial product, subtracted from the partial product, or left unchanged according to following rules:
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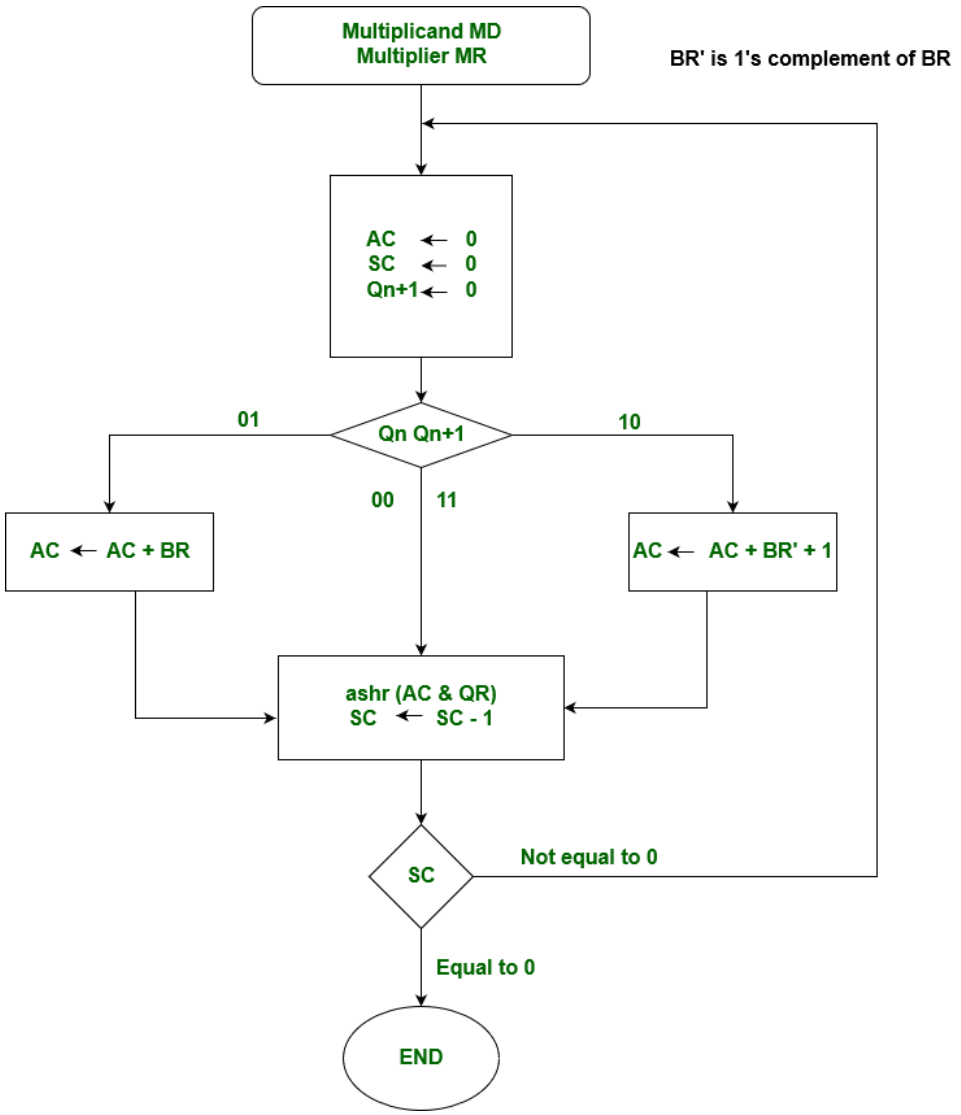
- Learn all GATE CS concepts with Free Live Classes on our youtube channel.
- The multiplicand is subtracted from the partial product upon encountering the first least significant 1 in a string of 1's in the multiplier
- The multiplicand is added to the partial product upon encountering the first 0 (provided that there was a previous '1') in a string of 0's in the multiplier.
- The partial product does not change when the multiplier bit is identical to the previous multiplier bit.

- The register as A, B and Q, AC, BR and QR respectively. Qn designates the least significant bit of multiplier in the register QR. An extra flip-flop Qn+1is appended to QR to facilitate a double inspection of the multiplier.

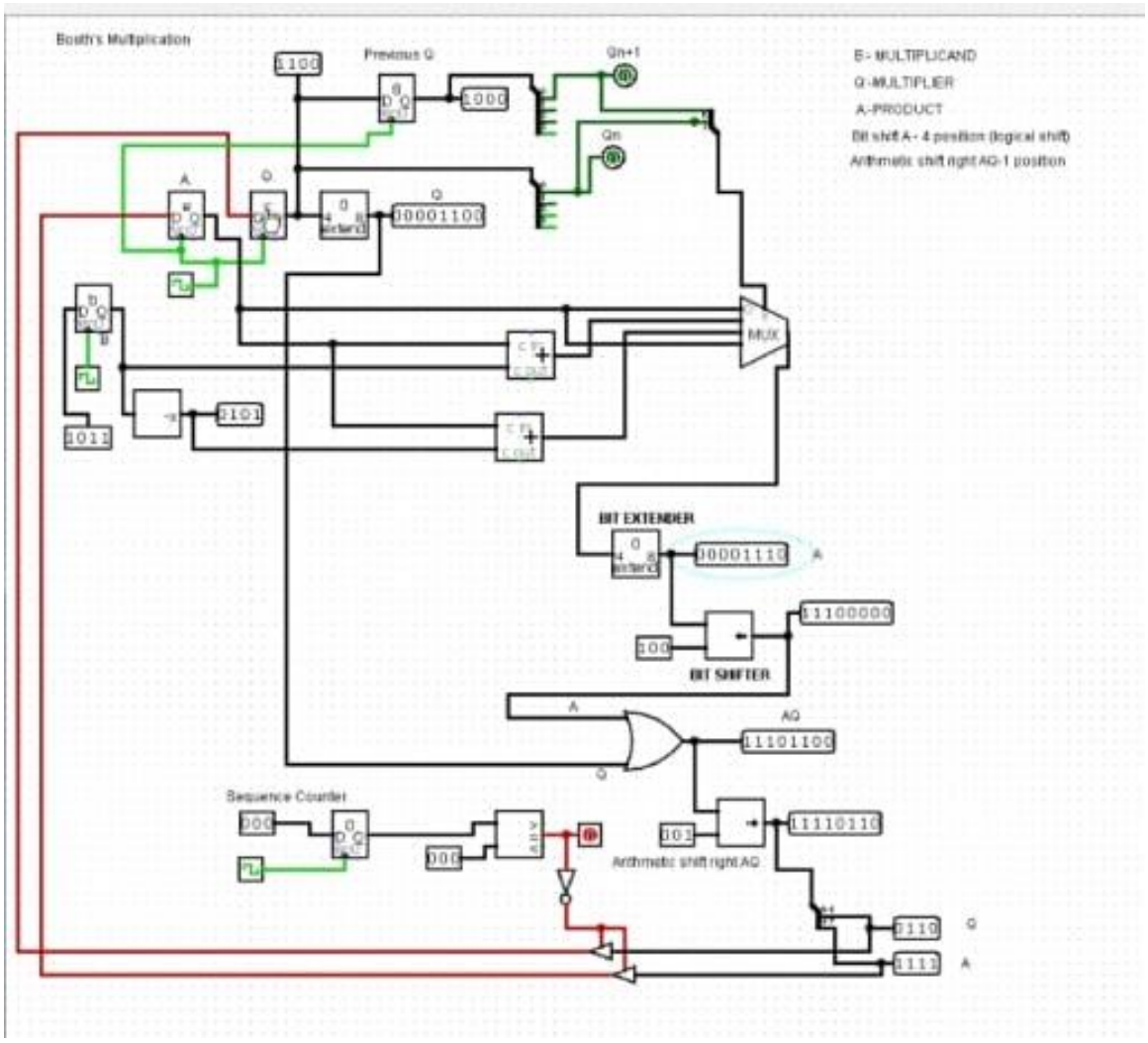


- AC and the appended bit Qn+1 are initially cleared to 0 and the sequence SC is set to a number n equal to the number of bits in the multiplier. The two bits of the multiplier in Qn and Qn+1are inspected. If the two bits are equal to 10, it means that the first 1 in a string has been encountered. This requires subtraction of the multiplicand from the partial product in AC. If the 2 bits are equal to 01, it means that the first 0 in a string of 0's has been encountered. This requires the addition of the multiplicand to the partial product in AC.

- When the two bits are equal, the partial product does not change. An overflow cannot occur because the addition and subtraction of the multiplicand follow each other. As a consequence, the 2 numbers that are added always have a opposite signs, a condition that excludes an overflow. The next step is to shift right the partial product and the multiplier (including Qn+1). This is an arithmetic shift right (ashr) operation which AC and QR ti the right and leaves the sign bit in AC unchanged. The sequence counter is decremented and the computational loop is repeated n times.

OUTPUT

-


Booth's Multiplication
Previous Q
Qn+1
Qn
B - MULTIPLICAND
Q -MULTIPLIER
A -PRODUCT
Bit shift A - 4 position (logical shift)
Arithmetic shift right AQ-1 position
A
Q
MUX
BIT EXTENDER
BIT SHIFTER
AQ
Sequence Counter
Arithmetic shift right AQ
1100
1000
00001100
2101
1011
00001110
11100000
100
11101100
000
11110110
011
1110
1111