Q1)
a)The **role** of a **boot loader** is to load an operating system from a storage device, set up a minimal environment in which the OS can run, and run the operating system's startup procedure.
b)A boot loader is a small program stored in the MBR or GUID partition table that helps to load an operating system into memory. Without a boot loader, your operating system can not be loaded into memory.
c)Types of boot loader in linux are as follows

1)GRUB is a popular and probably the most used multiboot Linux boot loader available, based on the original GRUB (GRand Unified Bootlader) which was created by Eirch Stefan Broleyn.
2)It comes with several improvements, new features and bug fixes as enhancements of the original GRUB program.
3)Importantly, GRUB 2 has now replaced the GRUB. And notably, the name GRUB was renamed to GRUB Legacy and is not actively developed, however, it can be used for booting older systems since bug fixes are still on going.
4)GRUB has the following prominent features:

- Supports multiboot
- Supports multiple hardware architectures and operating systems such as Linux and Windows
- Offers a Bash-like interactive command line interface for users to run GRUB commands as well interact with configuration files

ii) LILO:-
LILO is a simple yet powerful and stable Linux boot loader. With the growing popularity and use of GRUB, which has come with numerous improvements and powerful features, LILO has become less popular among Linux users.
While it loads, the word “LILO” is displayed on the screen and each letter appears before or after a particular event has occurred. However, the development of LILO was stopped in December 2015, it has a number of features as listed below:

- Does not offer an interactive command line interface
- Supports several error codes
- Offers no support for booting from a network
- All its files are stored in the first 1024 cylinders of a drive
- Faces limitation with BTFS, GPT and RAID plus many more.

iii) Burg :-

Based on GRUB, BURG is a relatively new Linux boot loader. Because it is derived from GRUB, it ships in with some of the primary GRUB features, nonetheless, it also offers remarkable features such as a new object format to

support multiple platforms including Linux, Windows, Mac OS, FreeBSD and beyond.

iv)Syslinux:-
Syslinux is an assortment of light weight boot loaders that enable booting from CD-ROMs, from a network and so on. It supports filesystems such as FAT for MS-DOS, and ext2, ext3, ext4 for Linux. It as well supports uncompressed single-device Btrfs.
Note that Syslinux only accesses files in its own partition, therefore, it does not offer multi-filesystem boot capabilities

Q2) Describe X-window system ?

The X Window System (X11) is an open source, cross platform, client-server computer software system that provides a GUI in a distributed network environment.
Used primarily on Unix variants, X versions are also available for other operating systems. Features of the X window system include network transparency, the ability to link to different networks, and customizable graphical capabilities. The X window system was first developed in 1984, as part of project Athena, a collaboration between Stanford University and MIT. X.Org Foundation, an open group, manages the development and standardization of the X window system.
The X Window System is also known simply as X, X11 or X Windows.
The client/server model in X system works in reverse to typical client/server model, where the client runs on the local machine and asks for services from the server. In X system, the server runs on the local machine and provides its display and services to the client programs. The client programs may be local or remotely exist over different networks, but appear transparently.
X is used in networks of interconnected mainframes, minicomputers, workstations, and X Terminals. X window system consists of a number of interacting components, including:

- X server: Manages the display and input hardware. It captures command-based and graphics-based inputs from input hardware and passes it to the client application that requested it. It also receives inputs from the client applications and displays the output under guidance from windows manager. The only component that interacts with hardware is X server. This makes it easier to recode it as per the requirements of different hardware architectures.
- Windows manager: Is the client application that manages client windows. It controls the general operations of the window system like geometry, appearance, coordinates, and graphical properties of X display. Window manager can change the size and position of windows on the display and reshuffle windows in a window stack.

- X client: Is an application program that communicates with X server using X protocol. Xterm, Xclock, and Xcalc are examples of X clients. X manages its windows in a hierarchal structure. The shaded area that fills the entire screen is the root window. X client application windows are displayed on top of the root window and are often called the children of the root.

Q3) Check echo is an internal or external command , change the permission of the file ,concatenation of exitising files

In terminal write the following commands one by one
1. type echo

to set permission read + write + execute
2 chmod 755 filename.sh

3. cat file1.txt >> file2.txt

Q4)

1)programs that grant users access to a system use authentication to verify each other's identity
(that is, to establish that a user is who they say they are).

2)Historically, each program had its own way of authenticating users. In Red Hat Enterprise Linux, many programs are configured to use a centralized authentication mechanism called Pluggable Authentication Modules (PAM).

3)PAM uses a pluggable, modular architecture, which affords the system administrator a great deal of flexibility in setting authentication policies for the system.

4)In most situations, the default PAM configuration file for a PAM-aware application is sufficient. Sometimes, however, it is necessary to edit a PAM configuration file. Because misconfiguration of PAM can compromise system security, it is important to understand the structure of these files before making any modifications

PAM offers the following advantages:

- a common authentication scheme that can be used with a wide variety of applications.

- significant flexibility and control over authentication for both system

administrators and application developers.

- a single, fully-documented library which allows developers to write programs without having to create their own authentication schemes

Q5)

To configure a host, we require the following things:

- **Leased IP address** – IP address to a host which lasts for a particular duration which goes for a few hours,few days or few weeks.
- **Subnet Mask** – The host can know on which network it is on.
- **Gateway address** – The Gateway is the Internet Service Provider that connects user to the internet.The Gateway address lets the host know where the gateway is to connect to the internet.

DHCP Entities

- **DHCP server:** It automatically provides network information(IPaddress, subnet mask, gateway address) on lease. Once the duration is expired, that network information can be assigned to other machine. It also maintains the data storage which stores the available IP addresses.
- **DHCP client:** Any node which request an IP address allocation to a network is considered as DHCP client.
- **DHCP Relay Agent:** In case, we have only one DHCP server for multiple LAN's then this Agent which presents in every network forwards the DHCP request to DHCP server. So, using DHCP Relay Agent we can configure multiple LAN's with single server.

How DHCP server assigns IP address to a host?

1. **DHCPDISCOVER:** When a new node is connected to the network, it broadcasts the DHCPDISCOVER message which contains the source address as 0.0.0.0 to every node on the network including server. DHCP server on receiving the message, returns the DHCPOFFER message to the requested host which contains the server address and new IP address to the node.
2. **DHCPOFFER:** If there are multiple servers on the network, host receives multiple DHCPOFFER messages. It is up to the host to select a particular message.
3. **DHCPREQUEST:** The requested host on receiving the offer message, it again broadcasts the DHCPREQUEST message on the network with the address of the server whose offer message is accepted by the host. The server which pertains to that server address sent by the host checks whether the address to be assigned to the node is available in the data storage.
4. **DHCPACK :** If the address is assigned , it marks the IP address in the storage as unavailable to ensure consistency. Now, the server sends DHCPACK packet to the requested host which contains network information(IP address, subnet mask, gateway address). In case, if the address is assigned to other machine meanwhile, then the server sends the

packet DHCPNAK to the requested host indicating that the IP address is assigned to some other machine.

5. **DHCPRELEASE :** And finally, If the host wants to move to other network or if it has finished its work, it sends the DHCPRELEASE packet to the server indicating that it wants to disconnect. Then the server marks the IP address as available in the storage so that it can be assigned to other machine.

Q6)

standard Linux Distribution provides the choice of partitioning disk with the file formats listed below, each of which has special meaning associated with it.

- ext2
- ext3
- ext4
- jfs
- ReiserFS
- XFS
- Btrfs

ext2, ext3, ext4

These are the progressive version of Extended Filesystem (ext), which primarily was developed for MINIX. The second extended version (ext2) was an improved version. Ext3 added performance improvement. Ext4 was a performance improvement besides additional providing additional features.

JFS

The Journaled File System (JFS) was developed by IBM for AIX UNIX which was used as an alternative to system ext. JFS is an alternative to ext4 currently and is used where stability is required with the use of very few resources. When CPU power is limited JFS comes handy.

Q7)Eyes of permission granted in linux

Every file and directory in your UNIX/Linux system has following 3 permissions defined for all the 3 owners discussed above.

- **Read:** This permission give you the authority to open and read a file. Read permission on a directory gives you the ability to lists its content.
- **Write:** The write permission gives you the authority to modify the contents of a file. The write permission on a directory gives you the authority to add, remove and rename files stored in the directory. Consider a scenario where you have to write permission on file but do not have write permission on the directory where the file is stored. You will be able to modify the file contents. But you will not be able to rename, move or remove the file from the directory.
- **Execute:** In Windows, an executable program usually has an extension ".exe" and which you can easily run. In Unix/Linux, you cannot run a program unless the execute permission is set. If the execute permission is

not set, you might still be able to see/modify the program code(provided read & write permissions are set), but not run it.

- **r** = read permission
  w = write permission
  x = execute permission
  - = no permission

Q8)DNS

1)The Domain Name System (DNS) is the phonebook of the Internet. Humans access information online through domain names, like nytimes.com or espn.com. Web browsers interact through Internet Protocol (IP) addresses. DNS translates domain names to Ip address so browsers can load Internet resources.

2)Each device connected to the Internet has a unique IP address which other machines use to find the device. DNS servers eliminate the need for humans to memorize IP addresses such as 192.168.1.1 (in IPv4), or more complex newer alphanumeric IP addresses such as 2400:cb00:2048:1::c629:d7a2 (in IPv6).

3)The process of DNS resolution involves converting a hostname (such as www.example.com) into a computer-friendly IP address (such as 192.168.1.1). An IP address is given to each device on the Internet, and that address is necessary to find the appropriate Internet device - like a street address is used to find a particular home.

4)When a user wants to load a webpage, a translation must occur between what a user types into their web browser (example.com) and the machine-friendly address necessary to locate the example.com webpage.

5)In order to understand the process behind the DNS resolution, it’s important to learn about the different hardware components a DNS query must pass between. For the web browser, the DNS lookup occurs “ behind the scenes” and requires no interaction from the user’s computer apart from the initial request.

Q9) vi editor

1)The default editor that comes with the UNIX operating system is called vi (visual editor). Using vi editor, we can edit an existing file or create a new file from scratch. we can also use this editor to just read a text file.
2)Syntax vi filename

3)**Modes of Operation in vi editor** There are three modes of operation in vi:

- **Command Mode:** When vi starts up, it is in Command Mode. This mode is where vi interprets any characters we type as commands and thus does not display them in the window. This mode allows us to move through a file, and to delete, copy, or paste a piece of text.
  To enter into Command Mode from any other mode, it requires pressing the **[Esc]** key. If we press [Esc] when we are already in Command Mode, then vi will beep or flash the screen.
- **Insert mode:** This mode enables you to insert text into the file. Everything that's typed in this mode is interpreted as input and finally, it is put in the file. The vi always starts in command mode. To enter text, you must be in insert mode. To come in insert mode you simply type i. To get out of insert mode, press the Esc key, which will put you back into command mode

4)**Deleting Characters:** Here is the list of important commands which can be used to delete characters and lines in an opened file.

- ***X*** *: Deletes the character under the cursor location.*
- ***X*** *: Deletes the character before the cursor location.*
- ***Dw*** *: Deletes from the current cursor location to the next word.*
- ***d^*** *: Deletes from current cursor position to the beginning of the line.*
- ***d$*** *: Deletes from current cursor position to the end of the line.*
- ***Dd*** *: Deletes the line the cursor is on.*