Ip subnet

Address Class	RANGE	Default Subnet Mask
A	1.0.0.0 to 126.255.255.255	255.0.0.0
B	128.0.0.0 to 191.255.255.255	255.255.0.0
C	192.0.0.0 to 223.255.255.255	255.255.255.0
D	224.0.0.0 to 239.255.255.255	Reserved for Multicasting
E	240.0.0.0 to 254.255.255.255	Experimental

Note: Class A addresses 127.0.0.0 to 127.255.255.255 cannot be used and is reserved for loopback testing.

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

/26 is the new subnet mask
for these 4 subnets.

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26	192.168.4.1-192.168.4.62	62	192.168.4.63
192.168.4.64	/26	192.168.4.65-192.168.4.126	62	192.168.4.127
192.168.4.128	/26	192.168.4.129-192.168.4.190	62	192.168.4.191
192.168.4.192	/26	192.168.4.193-192.168.4.254	62	192.168.4.255

Subnetting - Class C

- Network: 192.168.80.0   Subnet Mask: 255.255.255.224
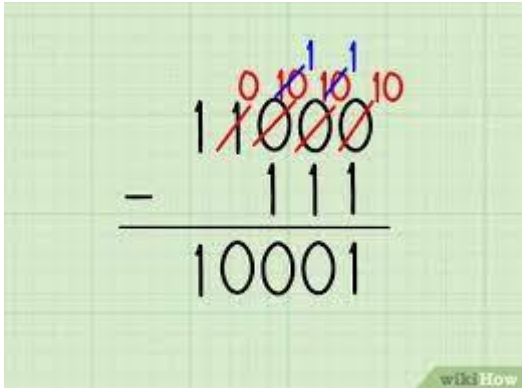- Network: 27 bits   Host: 5 bits   Magic Number: $2^5 = 32$

ID	Network Address	Subnet Address Range	Broadcast Address
0	192.168.80.0	192.168.80.1 – 192.168.80.30	192.168.80.31
1	192.168.80.32	192.168.80.33 – 192.168.80.62	192.168.80.63
2	192.168.80.64	192.168.80.65 – 192.168.80.94	192.168.80.95
3	192.168.80.96	192.168.80.97 – 192.168.80.126	192.168.80.127
4	192.168.80.128	192.168.80.129 – 192.168.80.158	192.168.80.159
5	192.168.80.160	192.168.80.161 – 192.168.80.190	192.168.80.191
6	192.168.80.192	192.168.80.193 – 192.168.80.222	192.168.80.223
7	192.168.80.224	192.168.80.225 – 192.168.80.254	192.168.80.255

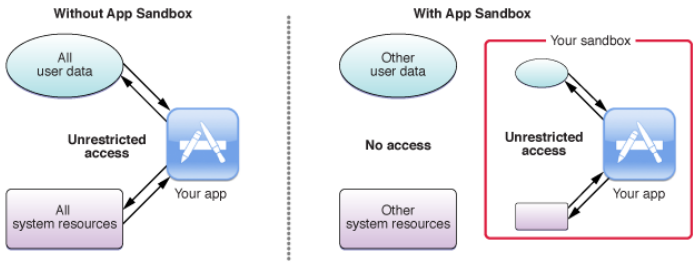CCNA1-47   Chapter 6-2

openflow

OpenFlow is a communications protocol that gives access to the forwarding plane of a network switch or router over the network.In the early stages of the discussion, SDN was used synonymously with OpenFlow, a new standard communications protocol between the control and forwarding layers of a software-driven network.

	$1 - 0 = 1$ $0 - 1 = 1$ (borrow 1 from next high order digit)) $1 - 1 = 0$ $10 - 1 = 1$ $11 - 1 = 10$
AMD processor	For heavier tasks recommended are at least mid-range processors, such as AMD Ryzen or Intel Core i series. 1. Lenovo IdeaPad 3 15. 2. 2.6 GHz AMD Ryzen 3 5300U processor 3. 8 GB DDR4 memory 4. AMD Ryzen 3 5300U Intel Core i5-1145G7 AMD Ryzen 5 5500U Cores / Threads 4 / 8 4 / 8 6 / 12 5. 7 nm 10 nm 7 nm 6. 3- Better multitasking more core help in multi-tasking. Cons- 1-lower single core performance. 2-lower boost clock speed.
Full stack	A full stack developer is a web developer or engineer who works with both the front and back ends of a website or application—meaning they can tackle projects that involve databases, building user-facing websites, or even work with clients during the planning phase of projects.
Broadcom	Broadcom is the market leader for switching merchant silicon's used in network switches. There are other vendors such as Mellanox, Marvel, EZChip, Microsemi and Cavium, **1- Strata XGS Family includes the following silicon** Trident 2 (10g / 40G) Trident 2+ (10G / 40G , Enhanced Trident 2 , with VXLAN Routing) Tomahawk (100G) **2- Strata DNX Family (Also known as Dune family)** Qumran (10G/40G) Jericho (packet processor)

	FE 3600 (Fabric) This family is pretty new and is based on Broadcom acquisition of Dune networks. Feature wise, DNX comes from a different architecture has some benefits and advantages: 1. Expandable TCAM: 2. Expandable Packet Buffer : 3. Jericho+, Jericho2 delivers 5X higher bandwidth at 70% lower
Jerico-2	Up to 10Tb/s switching capacity per device. 400G/100G Ethernet port density Cost parity for comparable port Density programmable pipeline **Deep buffers:** Deep buffers (for burst handling), eliminating packet Drops They allow the network to accommodate some level of variation in the network traffic, simply put, a buffer is a reserved portion of memory where "overflow" data can be stored levels allow
JavaScript	JavaScript is a **client-side scripting language**, which means the source code is processed by the client's web browser rather than on the web server. This means JavaScript functions can run after a webpage has loaded without communicating with the server. For example, a JavaScript function may check a web form before it is submitted to make sure all the required fields have been filled out. The Java Script code can produce an error message before any information is transmitted to the server. Like server-side scripting languages, such as php and asp, JavaScript code can be inserted anywhere within the HTML of a webpage
Cookies	Cookies are simple text files that contain two pieces of information: a website name and a unique identifier of some sort. This identifier could be a number or an alphanumeric string. When you visit a cookie-using website for the first time, it places a cookie in your web browser. When you visit this website again, it looks for the cookie so that it can tell whether you have visited before and how to best improve your experience for your latest visit. For example, the first time you visit a website, it might show you a message that welcomes you to the site and shows you how to find your way around via some simple instructions. Now, suppose you go back a couple of weeks later, the website knows you have been there before (via the cookie in your browser) so it shows you a 'welcome back' message instead.
sandbox	sandbox is a mechanism to securely run programs inside an environment from which it cannot affect other programs and have limited resources to use; example web browser ,virtual machine.

Nginx	Nginx, pronounced as engine-x, is an open-source web server which server more 25% websites across the globe, and also used as a reverse proxy and load balancer. Nginx is built to offer low memory usage and high concurrency. Rather than creating new processes for each web request, NGINX uses an asynchronous, event-driven approach where requests are handled in a single thread. Nginx has Worker connections and worker processes, one worker processes can maintain 1000 worker connections. Advantages of NGINX: * Open source. * A high speed web server which can be used as a reverse-proxy server. * Can be used better in a virtual private server environment
VLAN	Virtual LANs (VLANs) allow network administrators to subdivide a physical network int logical broadcast domains. On a standard Layer 2 network, all hosts connected to a swit members of the same broadcast domain; and broadcast domains can only be physically separated across different switches by routers. VLANs are identified by a VLAN ID (a number between 0 – 4095), with the default VLAN network being VLAN 1. Each port on a switch or router can be assigned to be a member VLAN (i.e., to allow receiving and sending traffic on that VLAN). For example: on a switch, traffic that is sent to a port that is a member of VLAN be forwarded to any other VLAN 100 port on the switch, and it can also travel across a trunk port (connections between switches) to another switch and forwarded to all VLAN 100 ports on that switch. Traffic won't, however, be forwarded to ports that are on a dif VLAN ID. As VLANs are a Layer 2 protocol, Layer 3 routing is required to allow communication be VLANs, in the same way a router would segment and manage traffic between two subne on different switches. In order to implement VLANs, the routers and switches must sup several proprietary protocols in existence, the most commonly used protocol for configu VLANs is IEEE 802.1Q. VLANs are created by adding 32 bytes of data (a "tag") to the header portion of the ethernet frame. This allows the device to identify which VLAN a particular frame is associated with. VLANs are identified numerically from 1 to 4096 (the last 12 bits of the VLAN tag).
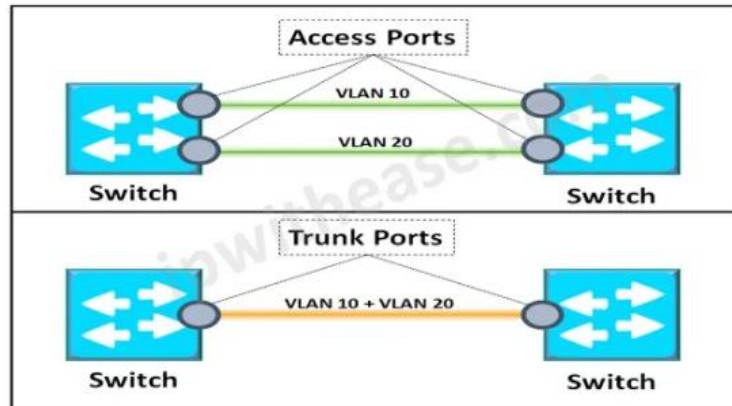
==Trunk links are required to pass VLAN information between switches. A port on a Cisco switch is either an access port or a trunk port.==

==Access ports –==
This switch ports belongs to carry the traffic of only one vlan. By default, it will carry the traffic of native vlan (VLAN 1)
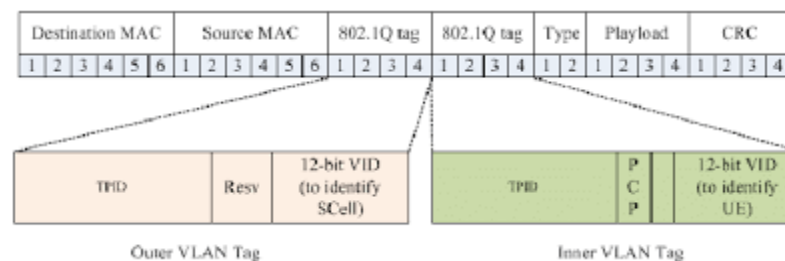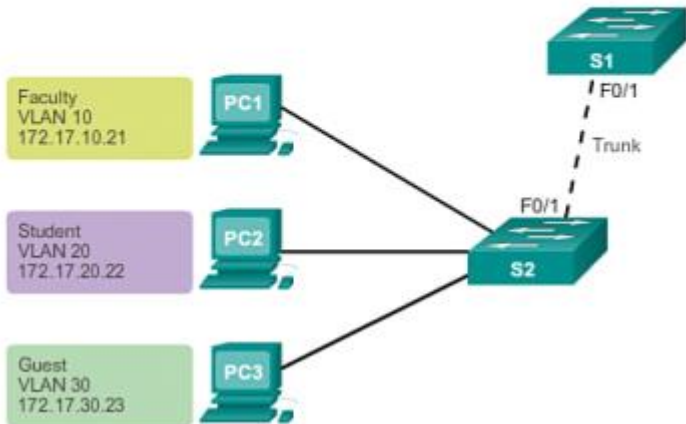
==Trunk ports –==
Switch port that can carry more than one VLAN traffic from one switch to another switch

==VLAN TAG==	When multiple VLANs travel in a trunk line they are tagged with their respective VLAN tags so that the receiving devices know which packet belongs to which VLAN.
	The VLAN tag was invented to distinguish among different VLAN broadcast domains on a group of LAN switches. ==The VLAN tag is a two-byte field inserted between the source MAC address and the Ethertype (or length) field in an Ethernet frame. Another two-byte field, t==he Tag Protocol Identifier (TPI or TPID), precedes the VLAN tag field.

VLAN 10 - Faculty/Staff - 172.17.10.0/24
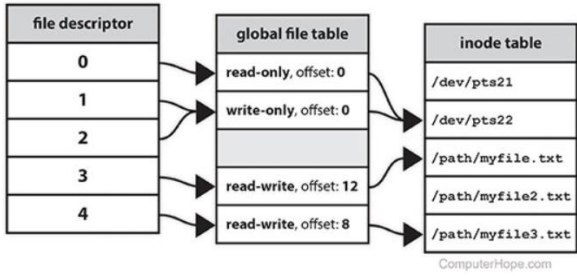VLAN 20 - Students - 172.17.20.0/24
VLAN 30 - Guest (Default) - 172.17.30.0/24
VLAN 99 - Management and Native - 172.17.99.0/24

Faculty VLAN 10 172.17.10.21 — PC1
Student VLAN 20 172.17.20.22 — PC2
Guest VLAN 30 172.17.30.23 — PC3
S1 F0/1 Trunk F0/1 S2 |
| IGMP snooping | IGMP snooping is the process of listening to Internet Group Management Protocol (IGMP) network traffic.
The feature allows a network switch to listen in on the IGMP conversation between hosts and routers. By listening to these conversations, the switch maintains a map of which links need which IP multicast streams. Multicasts may be filtered from the links which do not need them and thus controls which ports receive specific multicast traffic.

A switch will, by default, flood multicast traffic to all the ports in a broadcast domain (or the VLAN equivalent). Multicast can cause unnecessary load on host devices by requiring them to process packets they have not solicited. When purposefully exploited, this can form the basis of a denial-of-service attack. IGMP snooping is designed to prevent hosts on a local network from receiving traffic for a multicast group they have not explicitly joined. It provides switches with a mechanism to prune multicast traffic from links that do not contain a multicast listener (an IGMP client). |
| RED BLACK TREE | AVL tree is a self-balancing Binary Search Tree (BST) where the difference between heights of left and right subtrees cannot be more than one for all nodes.
=========

Red-Black Tree
===============

Red-Black Tree is a self-balancing Binary Search Tree (BST) where every node follows following rules.
RedBlackTree |

	1) Every node has a color either red or black. 2) Root of tree is always black. 3) There are no two adjacent red nodes (A red node cannot have a red parent or red chil 4) Every path from root to a NULL node has same number of black nodes. Why Red-Black Trees? Most of the BST operations (e.g., search, max, min, insert, delete.. etc) take O(h) time where h is the height of the BST. The cost of these operations may become O(n) for a skewed Binary tree. If we make sure that height of the tree remains O(Logn) after every insertion and deletion, then we Comparison with AVL Tree The AVL trees are more balanced compared to Red Black Trees, but they may cause more rotations during insertion and deletion. So if your application involves many frequent insertions and deletions, then Red Black trees should be preferred. And if the insertions and deletions are less frequent and search is more frequent operation, then AVL tree should be preferred over
<mark>**OSPF Support for Traffic Engineering**</mark>	Traffic engineering allows you to control the path that data packets follow, bypassing the standard routing model, which uses routing tables. <mark>**Traffic engineering moves flows from congested links to alternate links that would not be selected by the automatically computed destination-based shortest path**</mark>. <mark>OSPF uses Type 10 LSAs to collect TE information in an area, such as the bandwidth, priority, and link metrics.</mark> <mark>After processing the collected TE information, OSPF provides it for CSPF to calculate routes.</mark> When you enable traffic engineering for OSPF, the shortest-path-first (SPF) algorithm takes into account the various label-switched paths (LSPs) configured under MPLS and configures OSPF to generate <mark>**opaque link-state advertisements (LSAs)**</mark> that carry traffic engineering parameters. The parameters are used to populate the traffic engineering database. The traffic engineering database is used exclusively for calculating explicit paths for the placement of LSPs across the physical topology. The Constrained Shortest Path First (CSPF) algorithm uses the traffic engineering database to compute the paths that MPLS LSPs take. RSVP uses this path information to set up LSPs and to reserve bandwidth for them.

Dijkstra's algorithm	Dijkstra's algorithm is the better algorithm for the acyclic graph in which there is no negative edge. Dijkstra's have wasting a lot of memory and it cannot handle the **negative edges**.
File descriptor	One basic concept of Linux (actually Unix) is the rule that everything in Unix/Linux is a file. Each process has a table of file descriptors that point to files, sockets, devices and other operating system objects.

When a process makes a successful request to open a file, the kernel returns a file descriptor which points to an entry in the kernel's global file table. The file table entry contains information such as the inode of the file, byte offset, and the access restrictions for that data stream (read-only, write-only, etc.).

Stdin FD is 0 , Stdout FD is 1 ,stderr FD is 2 |
| **Select/poll/epoll** | simple solution is to create a thread (or process) for each client , block on read until a request is sent and write a response. This is working ok with a small number of clients but if we want to scale it to hundreds of clients, creating a thread for each client is a bad idea

IO Multiplexing

The solution is to use a kernel mechanism for polling over a set of file descriptors. There are 3 options you can use in Linux: select, poll,epoll

socket is a special file used for inter-process communication
I/O multiplexing allowing to examine and block on multiple I/O streams
File descriptor is a integer used to index into a table of files that a process has open.

Select (), poll (), epoll () three sets of I / O multiplexing system calls can listen to multiple file descriptors at the same time. They will wait for the timeout specified by the timeout parameter until an event occurs on one or more file descriptors. |

All the above methods serve the same idea, create a set of file descriptors , tell the kernel what would you like to do with each file descriptor (read, write, ..) and use one thread to block on one function call until at least one file descriptor requested operation available

1)select () system call

select does not bind the file descriptor and event.   The select system call monitors three sets of file descriptors

1. readfds,
2. writefds and
3. exceptfds.

1)poll () system call

Poll is somewhat smarter. It bind both file descriptors and events Using pollfd structure

3, epoll () system call

epoll is a Linux kernel system call for a scalable I/O to achieve better performance in more demanding applications, where the number of watched file descriptors is large (unlike the older system calls, which operate in O(n) time, epoll operates in O(1) epoll instance are in kernel

While working with select and poll we manage everything on user space and we send the sets on each call to wait. To add another socket we need to add it to the set and call select/poll again.
Epoll* system calls help us to create and manage the context in the kernel. We divide the task to 3 steps:
- create a context in the kernel using epoll_create
- add and remove file descriptors to/from the context using epoll_ctl
- wait for events in the context using epoll_wait

Epoll vs Select/Poll

- We can add and remove file descriptor while waiting
- epoll_wait returns only the objects with ready file descriptors
- epoll has better performance – O(1) instead of O(n)
- epoll can behave as level triggered or edge triggered (see man page)
- epoll is Linux specific so non portable

Asymptotic notation	Asymptotic notation, in computer science, big O notation is used to classify algorithms according to how their running time or space require grow as the input size grows.
Binary logarithm	Problems If there are 2 loops, Outer loops is incrementing sequentially , and inner loop is incrementing by multiplication of 2 , then complexity of double for loop is n log n. O(1) is better than linear time O(n) because the former is not depending on the input-size of the problem.
NVD	National Vulnerability Database (NVD) is a government repository of standards-based vulnerability information.
BST/AVL Complexity	search ,insertion and deletion in BST have worst case time complexity of O(n). However, AVL tree has worst case time complexity of O(logn).
private IP address	Port forwarding allows remote computers (for example, computers on the Internet) to connect to a specific computer or service within a private local-area network (LAN). Rogers: http://192.168.0.1/login.html Username: **cusadmin,**Password: **password** (or your current Wi-Fi password)

MacSec	Media Access Control security (MACsec) provides point-to-point security on Ethernet links. MACsec is defined by IEEE standard 802.1AE. You can use MACsec in combination with other security protocols, such as IP Security (IPsec) and Secure Sockets Layer (SSL), to provide end-to-end network security. First of all, MACsec and IPsec operate on different network layers. IPsec works on IP packets, at layer 3, while MACsec operates at layer 2, on ethernet frames. Thus, MACsec can protect all DHCP and ARP traffic, which IPsec cannot secure. On the other hand, IPsec can work across routers, while MACsec is limited to a LAN. With both MACsec and IPsec, user applications do not need to be modified to take advantage of the security guarantees that these standards provide.
How https works	1>When you enter the URL www.Google.com, Google's server gives its public key and Digital certificate (which was signed by GeoTrust) to the Browser. 2) Now browser has to verify the authenticity of the certificate i.e. it's actually signed From GeoTrust or not. As browsers come with a pre-installed list of public keys from all the major CA's, it picks the public key of the GeoTrust and tries to decrypt the digital signature of the certificate which was encrypted by the private key of GeoTrust. 3) If it's able to decrypt the signature (which means it's a trustworthy website) then it proceeds to the next step else it stops and shows a red cross before the URL. As I mentioned, Google sends its public key when you enter www.Google.com . Any data encrypted with this public key can only be decrypted by Google's private key which Google doesn't share with anyone. 2) After validating the certificate, browser creates a new key let's call it Session Key (symmetric key) and make 2 copies of it. These keys can encrypt as well as decrypt the data. 3) The browser then encrypts (1 copy of session key + other request data) with the Google's public key . Then it sends it back to the Google server. 4) Google's server decrypts the encrypted data using its private key and gets the session key , and other request data. Now, see, server and browser both have got the same copies of session key of the browser. No one else has this key, therefore, only server and browser can encrypt and decrypt the data. This key will now be used for both to decrypt and to encrypt the data. 5) If the user closes the website and opens again, a new session key would be created.
Open stack	Open stack is an opensource cloud platform alternative to proprietary solutions like Amazon AWS and Microsoft azure . Its an operating System for a cloud infrastructure. It is a management layer on top of all other components like hypervisors, SDN, VM images, Storage, etc. It is a software which help in creating private or public clouds. It, consists of a

	many inter-related projects for networking, storage, computing which can be deployed over the set of systems and a cloud infrastructure can be created, then this infrastructure can be used or rented to others for usage similar to how Amazon Clouds Services are. It can easily run-on commodity hardware and scale horizontally (just add more commodity hardware or PC)
RTOS	Properties of RTOS • time critical application • **preemptive scheduling policy,** • simplify the OS, many general-purpose functions (disk I/O) omitted
Moore's Law	Moore's Law is a computing term which originated around 1970; the simplified version of this law states that processor speeds, or overall processing power for computers will double every two years. To break down the law even further, it specifically stated that the number of transistors on an affordable CPU would double every two years. Network capacity. Butter's law says that the amount of data coming out of an optical fiber is doubling every nine months. Thus, the cost of transmitting a bit over an optical network decreases by half every nine months. Optical networking and dense wavelength-division multiplexing (DWDM) is rapidly bringing down the cost of networking, and further progress seems assured .
Data center fabric	A data center fabric is a system of switches and servers and the interconnections between them that can be represented as a fabric. .Cisco offering includes fabric management via Application Policy Infrastructure Controller (APIC) or Data Center Network Manager (DCNM)
C plus Plus	A class is an expanded concept of a data structure: instead of holding only data, it can hold both data and functions. ▪An object is a class variable or an "instance" of a class . ▪OOP is a design philosophy where program is divided into parts called objects. ▪Object Oriented Programming(OOP) employs the **bottom-up programming** approach. ▪In Procedure oriented programming (POP), program is divided into small functions ▪POP follows Top-Down approach The only difference between a struct and class in C++ is the default accessibility of member variables and methods. In a struct they are public; in a class they are private. **Polymorphism** : more than one function with same name and different working, In static polymorphism(**function overloading , templates ,default arguments and operator Overloading**) memory will be allocated at compile time. In run time polymorphism (Virtual function)memory will be allocated at runtime. **Data Abstraction** : hide inner details by making class members private the quality of dealing with ideas rather than events.

Encapsulation : wrapping data members and member functions in a single unit called class. Data is only accessible through the object of the class.

Inheritance : access the properties and features of base class into derived class.

1>A derived class with only one base class is called **single inheritance.**
2>A derived class with multiple base class is called **multiple inheritance.**
3>A derived class with two base classes and these two base classes have one common base class is called **multipath inheritance.**

virtual base class
In multipath inheritance. In CHILD class have two copies of Base class. This problem is also called as DIAMOND Problem.

This can be solved by declaring the common base class as a virtual base class
Now only one copy of the members of grandparent will be inherited into child

C++ storage classes?

Automatic variable ,stack segment, initial value garbage
External variable ,data segment, initial value 0
static variable ,data segment, initial value 0
register variable ,data segment, initial value garbage

What are storage qualifiers in C++ ?
Const ,volatile

iostream
is used to access the input output built in functions of the language same as stdio in c

Using Namespace std
C++ has a standard library that contains common functionality for building your applications like such as cin,cout,string or vector, algorithms. Import the entirety of the std namespace into the current namespace of program to avoid duplicates function without having to prefix std:: before each of these functions.

Structure/class
Structure default access type is public , but default class access type is private.
A structure is used for grouping data whereas class can be used for grouping data and methods.

Protected and private members
Protected access modifier is similar private access modifiers, the difference is that but they can be accessed by any subclass(derived class) of that class.

Friend function
- A friend function of a class is defined outside that class' scope but it has the right
to access all private and protected members of the class ...

Constructor
A constructor is a member function with the same name as its class. A constructor is
different from normal functions in following ways: Constructors don't have return type.
Constructor creates an object and initializes it. **It also creates vtable for virtual
functions.**

Default Constructor
Constructor with no arguments or all the arguments has default values.

copy constructor
A copy constructor is a member function which initializes an object using
another object of the same class.

Point p1(10); // Normal constructor is called here . Shallow copy
Point p2(p1); // Copy constructor is called here . Shallow copy
Point p2 = p1; // Copy constructor is called here . Shallow copy

Copy constructor and assignment operator, are the two ways to initialize one object
using another object. The fundamental difference between the copy constructor and
assignment operator is that the **copy constructor** allocates separate memory to both
the objects, i.e. the newly created target object and the source object.

The **assignment operator** allocates the same memory location to the newly
 created target object as well as the source object.

1. Default copy constructor does only shallow copy.
2. Deep copy is possible only with user defined copy constructor.

Copy constructors are called in following cases:

(a) when a function returns an object of that class by value
(b) when the object of that class is passed by value as an argument to a function
(c) when you construct an object based on another object of the same class
(d) When compiler generates a temporary object

Destructor is a member function which destructs or deletes an object. A destructor
function is called automatically when the object goes out of scope: the function ends, the
 program ends, a block containing local variables ends, a delete operator is called
Destructors have same name as the class preceded by a tilde (~), Destructors don't take
 any argument and don't return anything

Virtual function
A virtual function is a member function which is declared with a virtual keyword
 In a base class and is re-defined by a derived class. When you point to a derived class
object using a pointer to the base class, you can call a virtual function for that
object and execute the derived class's version
base* bptr;
derived d;
bptr = &d;

Abstract class
sometimes implementation of all function cannot be provided in a base class because
we don't know the implementation. Such base class is called abstract base class . An
abstract class is a class in C++ which have at least one pure virtual function. A pure
virtual function is declared by assigning 0 in declaration.

```
class Box {
   public:
      // pure virtual function
      virtual double getVolume() = 0;

   private:
      double length;      // Length of a box
      double breadth;     // Breadth of a box
      double height;      // Height of a box
};
```

vtable

Virtual functions are implemented using a table of function pointers, called the
vtable. There is one entry in the table per virtual function in the class. This table is
created by the constructor of the class. When a derived class is constructed, its base
class is constructed which creates the vtable. If the derived class overrides any of the
base classes virtual functions, those entries in the vtable are overwritten by the
derived class constructor. This is why you should never call virtual functions from a
constructor: because the vtable entries for the object may not have been set up by
the derived class constructor yet, so you might end up calling base class
implementations of those virtual functions

Why there are no virtual constructors in C++?
Constructor cannot be virtual because when constructor of a class is
executed there is no vtable in the memory means no virtual pointer defined yet.

Virtual destructor :you destroy an object through a pointer to a base class, and the
base-class destructor is not virtual, the derived-class destructors are
not executed, and the destruction might not be complete.
 So the base class destructor should be virtual to execute the destructors from derived

to base class order.The **insertion (<<) operator**,

There is only one copy of the static data member in the class,
 even if there are many class objects. ... The static data member is always
initialized to zero when the first-class object is created.

By declaring a function member as static, you make it independent of any
particular object of the class. A static member function can be called even
if no objects of the class exist and the static functions are accessed using
only the class name and the scope resolution operator ::.

Question: Can we have a recursive inline function in C++?
Answer: Even though it is possible to call an inline function from within itself in C++,
the compiler may not generate the inline code. This is so because the compiler won't be
able to determine the depth of the recursion at the compile time.

Question: Explain 'this' pointer?
Answer: The 'this' pointer is a constant pointer and it holds the memory address of the
current object. It passes as a hidden argument to all the nonstatic member function calls.
Also, it is available as a local variable within the body of all the nonstatic functions.
As static member functions can be called even without any object, i.e. with the
class name, the 'this' pointer is not available for them

```
class ClassName {
    private:
     int dataMember;
    public:
       method(int a) {
  // this pointer stores the address of object obj and access dataMember
        this->dataMember = a;
        ... .. ...
      }
}

int main() {
   ClassName obj;
   obj.method(5);
 }
```
Operator overloading
which an operator is overloaded to give user defined meaning to it. ...
 For example '+' operator can be overloaded to perform addition on
 various data types, like for Integer, String(concatenation) etc.

| | Exception handling in C++ consist of three keywords: try, throw and catch:

```cpp
try {
  int age = 15;
  if (age > 18) {
    cout << "Access granted - you are old enough.";
  } else {
    throw (age);
  }
}
catch (int myNum) {
  cout << "Access denied - You must be at least 18 years old.\n";
  cout << "Age is: " << myNum;
}
```

char* is a mutable pointer to a mutable character/string.const char* is a mutable pointer
char* is a **mutable** pointer to a **mutable** character/string.
const char* is a **mutable** pointer to an **immutable** character/string. You cannot change the contents of the location(s) this pointer points to


```cpp
class String
{
private:
    char *s;
    int size;
public:
    String(const char *str = NULL); // constructor
    String& operator=(String &c){
        size = strlen(c.s);
        s = new char[size+1];
        strcpy(s, c.s);
    }
    ~String() { delete [] s; }// destructor
    void print() { cout << s << endl; }
    void change(const char *); // Function to change
};
``` |

Copy constructor And operator overloading	```cpp
String::String(const char *str)
{
    size = strlen(str);
    s = new char[size+1];
    strcpy(s, str);
}

String::String(const String &src)
{
    size = src.size;
    s = new char[size+1];
    strcpy(s, src.s);
}

String::~String()
{
    delete [] s;
}

String& String::operator=(const String &rhs)
{
    if (&rhs != this)
    {
        String tmp(rhs);
        swap(s, tmp.s);
        swap(size, tmp.size);
    }
    return *this;
}

int main()
{
    String str1("learnc++");
    String str2 = str1;
```

t1 = t2 operator over loading |
| **New /malloc** | 1. For a dynamically allocated object, constructor is invoked by new operator<br>      Example geeks obj = new geeks()<br>      geeks obj = new geeks[4]; 4 objects created , to free used<br>      delete [] geeks<br>2. New doesn't need type casting, Malloc requires typecasting<br>3. New is a operator it can be overloaded, Malloc is a function cannot be overloaded |

4. New does not require to explicitly specifying the quantity of memory allocated,
5. If the new operator fails to allocate the memory, it throws an exception
   that must be handled by the code else the program will terminate.
6. new is related to delete , malloc is related to free

Once the memory is allocated using a new operator, it can't be resized

```cpp
struct BstNode
{
    int data;
    BstNode *left;
    BstNode *right;
};

/* Create New Node */
BstNode *createNode(int data)
{
    BstNode *newNode = new BstNode();

    newNode->data = data;
    newNode->left = NULL;
    newNode->right = NULL;
    return newNode;
}

/* Insert Node in Binary Search Tree */
BstNode *insertNode(BstNode *root, int data)
{
    if (root == NULL)
        root = createNode(data);
    else if (data <= root->data)
        root->left = insertNode(root->left, data);
    else
        root->right = insertNode(root->right, data);
    return root;
}
```
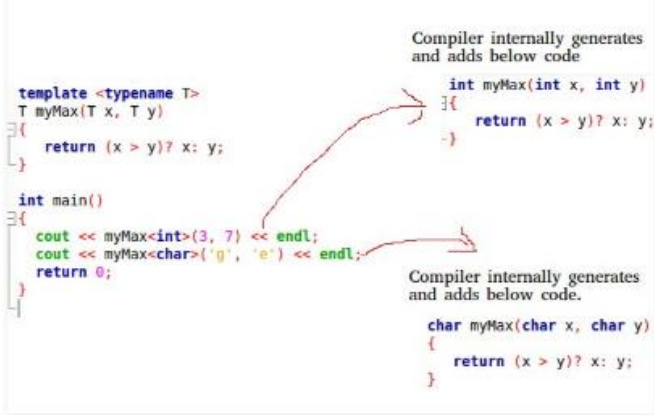
==template==	Templates are expanded at compiler time. This is like macros. The difference is, compiler **Does type check before template expansion.** The simple idea is to pass data type as a parameter so that we don't need to write the same code for different data types. For example, a software company may need sort() for different data types.

Function Templates We write a generic function that can be used for different data types. Examples of function templates are sort(), max(), min(), printArray().

Class Templates Like function templates, class templates are useful when a class defines something that is independent of the data type. Can be useful for classes like LinkedList, BinaryTree, Stack, Queue, Array, etc.

7.

Mutable keyword	Mutable data members are those members whose values can be changed in runtime even if the object is of constant type. It is just opposite to constant. **C++** The mutable storage class specifier is used only on a class data member to make it modifiable even declared as const. You cannot use the mutable specifier with names declared as static or const, or refere In the following example: ```class A { public: A() : x(4), y(5) { }; mutable int x; int y; }; int main() { const A var2; var2.x = 345; // var2.y = 2345; }``` the compiler would not allow the assignment var2.y = 2345 because var2 has been declared as const. T var2.x = 345 because A::x has been declared as mutable.
	The Standard Template Library (STL) is a set of C++ template classes to provide common programming data structures and functions such as lists, stacks, arrays, etc.

CONTAINERS

SEQUENCE   ADAPTER   ASSOCIATIVE   UNORDERD

VECTOR
LIST
DEQUE
ARRAYS

QUEUE
PRIORITY
QUEUE
STACK

SET
MULTI-SET
MAP
MULTI-MAP

UNORDERED
SET
UNORDERED
MAP
UNORDERED
MULTI-SET
UNORDERED
MULTI-MAP

container classes store objects and data and it has methods for accessing its elements. In particular, every type that is a model of Container has an associated iterator type .iterators is like a pointer and provide a means for accessing data stored in container classes
such a vector, map, list, etc

Sequence Containers
Sequence containers are used for data structures that store objects of the same type in a linear manner. The STL Sequence Container types are:

The STL SequenceContainer types are:

- array represents a static contiguous array
- vector represents a dynamic contiguous array
- forward_list represents a singly-linked list
- list represents a doubly-linked list
- deque represents a double-ended queue, where elements can be
- added to the front or back of the queue.

While std::string is not included in most container lists, it does in fact meet
 the requirements of a SequenceContainer.

Adapters Containers

They are wrappers around other container types (such as a vector, deque, or list). Example Stack (LIFO), queue(FIFO), priority queue .a priority queue is an abstract
 data type similar to regular queue or stack data structure in which each element additionally has a "priority" associated with it. In a priority queue, an element with high priority is served before an element with low priority largest element (by default)

Associative Containers
The C++ library provides eight associative containers Associative containers store
 elements which are retrieved by a key

	Ordered Set and Map are balanced binary search tree (Red-Black Tree) Thus, you use them when you want insertion ,searching, deletion in O(log n). They don't allow duplicates. the elements are kept in order of the keys (ascending by default), which sometimes can be useful. Example set<int> s; store counters 1 to 100 Student marks and roll number, The roll number is the key and each student has a different roll number, hence unique key representing them. Example map<int, int> marks; A common problem for hash tables is that the worst case cannot be guaranteed (though the likelihood is very small), which renders it extremely vulnerable in cyber-attacks. That's why hash maps are not appreciated in systems demanding real-time performance. Unordered Set and Map are an implementation of Hash Tables. So, you use them when on average you want insertion, search, deletion in O(1). Though, worst case will O(n). Unordered map is more efficient that map, as it's based on hash tables, which provides insertion and deletion time complexity close to O(1). However, it does not sort the keys as map does.
<mark>Q&A</mark>	A dangling pointer arises when you use the address of an object after its lifetime is over.

```
// function definition to swap the values.
void swap(int &x, int &y) {
   int temp;
   temp = x; /* save the value at address x */
   x = y;    /* put y into x */
   y = temp; /* put x into y */

   return;
}
```

References are less powerful than pointers
1) Once a reference is created, it cannot be later made to reference another object;
2) References cannot be NULL.
3) A reference must be initialized when declared.

What do you mean by Stack unwinding?
It is a process during exception handling when the destructor is called for all local objects between the place where the exception was thrown and where it is caught.

If B is a **shallow copy** of A . *B and A point to the same memory location.* If B is a **deep copy** of A, *B and A point to different memory locations*

<mark>What is inline function?</mark>
The inline, substitution occurs only at the compiler's discretion. Can inline functions cannot have recursion?

	Overriding a method means that replacing a method functionality in derived class. Explain the scope resolution operator? It permits a program to reference an identifier in the global scope that has been hidden by another identifier with the same name in the local scope. Manipulators are the functions which can be used in conjunction with the insertion (<<) and extraction (>>) operators on an object. Examples are endl and setw.

<mark>Smart pointer</mark>	In C++ 11, it introduces smart pointers .A smart pointer is a container class that wraps a 'raw' (or 'bare') C++ pointer, to manage the lifetime of the object being pointed to. Smart pointers should be preferred over raw pointers. With raw pointers, the programmer has to explicitly destroy the object when it is no longer useful.
	
	``cpp
	void my_func()
	{
	    int* valuePtr = new int(15);
	    int x = 45;
	    // ...
	    if (x == 45)
	        return; // here we have a memory leak, valuePtr is not deleted
	    // ...
	    delete valuePtr;
	}
	
	int main()
	{
	}
	``
	
	The same example using the unique_ptr<> template:
	
	`Run this code`
	
	``cpp
	#include <memory>
	
	void my_func()
	{
	    std::unique_ptr<int> valuePtr(new int(15));
	    int x = 45;
	    // ...
	    if (x == 45)
	        return; // no memory leak anymore!
	    // ...
	}
	
	int main()
	{
	}
	``

<mark>Lambda Function</mark>	C++ 11 introduced lambda expression to allow us write an inline function which can be used for short snippets of code that are not going to be reuse and not worth naming. In its simplest form lambda expression can be defined as follows:

| | ```
[ capture clause ] (parameters) -> return-type
{
    definition of method
}
```<br><br>```cpp
vector<int> v {4, 1, 3, 5, 2, 3, 1, 7};

printVector(v);

// below snippet find first number greater than 4
// find_if searches for an element for which
// function(third argument) returns true
vector<int>:: iterator p = find_if(v.begin(), v.end(), [](int i)
{
    return i > 4;
});
cout << "First number greater than 4 is : " << *p << endl;
``` |
| Move constructor | ```
/*
A copy constructor constructs a new object by using the content of the argument object. An
overloaded assignment operator assigns the contents of an existing object to another existing
object of the same class.
*/


/*In the above code, there is a serious performance overhead as the temporary object cpym is first
created in the default constructor and then in the copy constructor. The move constructor is
used to avoid this performance overhead:
*/
/*
The move assignment operator is different than a move constructor because a move assignment
 operator is called on an existing object, while a move constructor is called on an object created by the ope
Thereafter, the other object's data is no longer valid.
*/
``` |

```cpp
*/
class Names{
private:
    string* name;
public:
    Names(string place_name){
        cout << "Overloaded constructor" << endl;
        name = new string;
        *name = place_name;
    }
    //copy constructor
    Names(Names& cpy){
        cout << "Copy constructor" << endl;
        name = new string;
        *name = *cpy.name;
    }
    //assignment
    Names& operator =(const Names& cpy){
        cout << "Assignment operator" << endl;
        name = new string;
        *name = *cpy.name;
        return *this;
    }
        // Move constructor
    // It will simply shift the resources,
    // without creating a copy
    //move constructor
        //With the move constructor, the copy of the temporary object of cpym is avoided
    Names(Names&& cpym){
        cout << "Copy move constructor" << endl;
        name = cpym.name;
        cpym.name = NULL;
    }
    //move assignment operator
    Names& operator=(Names&& cpym){
        cout << "Copy assignment operator" << endl;
        delete name;
        name = cpym.name;
        cpym.name = NULL;
        return *this;
    }
        `


int main(){
    Names nme("Bob");
    Names copin("something");
    copin = nme;
    system("pause");
    return 0;
}
```

	Design patterns are documented tried and tested solutions for recurring problems in a given context.
	
	The singleton pattern is used to limit creation of a class to only one object. Examples Including caches, thread pools, and registries.
	A log file is the big one. You don't want to just abandon a single log file. You want to flush, sync and close it properly. This is an example of a single shared resource that has to be manage
	
	``
	// design pattern
	class Singleton
	{
	    private static Singleton obj;
	
	    // private constructor to force use of
	    // getInstance() to create Singleton object
	    private Singleton() {}
	
	    public static Singleton getInstance()
	    {
	        if (obj==null)
	            obj = new Singleton();
	        return obj;
	    }
	}
	``
	
	You can create a singleton class by making its constructor as private, so that you can restrict the creation of the object. Provide a static method to get instance of the object, wherein you can handle the object creation inside the class only.
	
	Major disadvantages
	1. an inhibiting feature when more than one instance is required.
	2. Difficult to make thread-safe.
	3. Global access to singleton object is a bad design practice.
	4. Singleton does not support inheritance of the class.
	5 make unit testing very hard
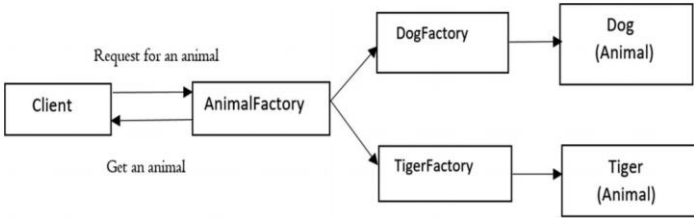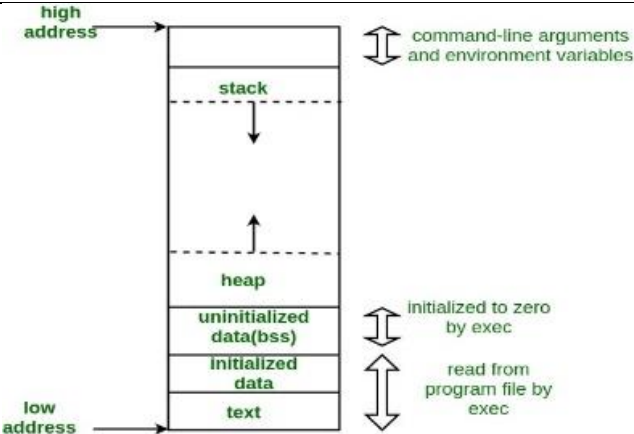	
	Factory Method
	
	Factory pattern says that object creation will be handled by subclass class using the input type. We are building an application that needs to support two different databases, Oracle and SQL Server.
	Whenever we insert a data into a database, we create a SQL Server– specific connection or an Oracle server– specific connection and then we can proceed. If we put these codes into if-else (or switch) statements, we may need to repeat a lot of code.
	
	This kind of code is not easily maintainable because whenever we need to support a new type connection, we need to reopen code and place the modifications. A factory method pattern focuses on solving similar problems in application development.

	## Factory Method Pattern Request for an animal Client — AnimalFactory → DogFactory → Dog (Animal) Get an animal → TigerFactory → Tiger (Animal) ❑ This figure shows how to get animal objects in the factory method pattern. ❑ Using the factory method pattern that allows subclasses to decide how the instantiation process is completed. ❑ We delegate the objects creation to the subclasses that implement the factory method to create objects.
Memory Layout of C Programs	high address — command-line arguments and environment variables stack heap uninitialized data(bss) — initialized to zero by exec initialized data — read from program file by exec low address — text **From low to high memory** **1 Text Segment:** contains executable instructions. **2. Data Segment:** contains global & static variables 3. heap goes up 4. stack goes down
Dynamic Programming	1. In Dynamic Programming, a problem is divided into sub-problems, 2. Solutions of these sub-problems combined together overall solution. 3. Dynamic Programming solve each of these sub-problems just once. 4. Memorization is a term describing an optimization technique where you cache previously computed results, and return the cached result when the same computation is needed again
Mutex V/s Semaphore	1> In **mutexes has an ownership property**, only the **thread** that took the **lock** has the key. Only that thread alone can release the lock. Binary semaphores doesn't have an ownership property, as any thread can take the key to open the lock. 2)A semaphore is a generalized mutex. In lieu of single buffer, we can **split** the 4 KB buffer into four 1 KB buffers (identical resources). A semaphore

	can be associated with these four buffers. The consumer and producer can work on different buffers at the same time.
virtualization	A software container is a way to bundle and isolate processes (software) running on a server. Virtual machines and containers differ in several ways, but the primary difference is that containers provide a way to virtualize an OS so that multiple workloads can run on a single OS instance. With VMs, the hardware is being virtualized to run multiple OS instances.
Docker/ Kubernetes	Docker is what enables us to run, create and manage containers on a single host Kubernetes can then allow you to automate container provisioning, networking, load-balancing, security and scaling across all these nodes from a single command line or dashboard. A collection of nodes that is managed by a single Kubernetes instance is referred to as a Kubernetes cluster. Now, why would you need to have multiple nodes in the first place? The two main motivations behind it are: 1. To make the infrastructure more robust: Your application will be online, even if 2. some of the nodes go offline, i.e, High availability. 3. To make your application more scalable: If workload increases, simply spawn more 4. containers and/or add more nodes to your Kubernetes cluster. Kubernetes automates the process of scaling, managing, updating and removing containers. In other words, it is a container orchestration platform. While Docker is at the heart of the containerization, it enables us to have containers in the first place. Differences Between Kubernetes and Docker In principle, Kubernetes can work with any containerization technology.
ASLR	Address space layout randomization (ASLR) is a memory-protection process for operating systems (OSes) that guards against buffer-overflow attacks by randomizing the location where system executables are loaded into memory. The success of many cyberattacks, particularly zero-day exploits, relies on the hacker's ability to know or guess the position of processes and functions in memory. ASLR is able to put address space targets in unpredictable locations. If an attacker attempts to exploit an incorrect address space location, the target application will crash, stopping the attack and alerting the system. ASLR works alongside virtual memory management to randomize the locations of different parts of the program in memory. Every time the program is run, components (including the stack, heap, and libraries) are moved to a different address in virtual
Object Size Checking (OSC)	Object Size Checking (OSC) leverages a builtin compiler technique to determine buffer overflows in C/C++ code. various optimization passes enabled with -O2
xspace	Making the stack (and heap) non-executable provides a high degree of protection against many types of buffer overflow attacks for existing programs. is that execution occurs in the code section, which is neither stack nor heap.

<mark>GPB</mark>	Google has a tremendous amount of internal traffic. It makes sense for the company to optimize communication between internal services to make it as efficient as possible, as this directly translates to monetary savings (fewer CPU cycles spent on communication = less energy consumed) as well as more responsive public-facing applications and services. The serialization problem has been solved in other ways, of course. XML is a very robust data serialization format which provides most of the benefits you would want. It is standardized, and libraries have naturally been built in every major programming language to parse and generate it. JSON is similarly popular, though not quite as expressive (but even more concise and, arguably, more readable). But XML and JSON have some baggage. For one, both are designed to be human readable. This of course requires that they be text-based, which means that for the purpose of transporting messages in either format data must be encoded on one end and then decoded on the other end. They are also self-describing. This is a big benefit, but it also necessarily increases message size, since some sort of schema information needs to be included in the message itself. Protocol buffers are not self-describing. Both parties (sender and receiver) must have a <mark>shared schema</mark> in order to understand what a message means. This is fine for <mark>internal</mark> service calls (it's actually also fine for a public API, though it requires more care), and it allows messages to be much more compact—which of course contributes to <mark>throughput</mark> (obviously, it takes less time to transmit a smaller message than a larger one). They are also binary, not text-based, which improves efficiency by eliminating the encoding and decoding steps. So protocol buffers provide a lot of value as a data serialization format, in the same way that other serialization formats like XML and JSON do. But they also offer much greater efficiency, which is a significant part of the reason Google developed and uses them. Protocol buffers are a <mark>language-neutral</mark> way of serializing structured data. If two applications want to communicate structures (with multiple fields) over a wire / network, the structure is serialized using Protocol Buffers • They are a simple interface for serializing structured data. • They are 3 to 10 times smaller than XML. • They are 20 to 100 times faster than XML to parse and serialize. • The protoc compiler generates easy-to-use data classes in many client languages. As you can imagine,
<mark>Reader-writer lock</mark>	When a writer is writing the data, all other writers or readers will be blocked until the writer is finished writing. Readers–writer locks are usually constructed on top of mutexes and condition variables, or on top of semaphores.
<mark>STACK</mark>	**Key Differences Between Stack and Heap Allocations** 1. In a stack, the allocation and deallocation is automatically done by whereas, in heap, it needs to be done by the programmer manually. 2. Memory shortage problem is more likely to happen in stack whereas the main issue in heap memory is fragmentation. 3. <mark>Stack is not flexible, the memory size allotted cannot be change</mark>

mutual exclusion	A **mutual exclusion** (mutex) is a program object that prevents simultaneous access to a shared resource (critical section) by two or more threads
Deadlock	**Deadlock can arise if following four conditions hold simultaneously** *Mutual Exclusion:* One or more than one resource are non-sharable 　　　　　　　　　(Only one process can use at a time) *Hold and Wait:* A process is holding at least one resource and waiting for resources. *No Preemption:* A resource cannot be taken from a process unless the process releases 　　　　　　the resource. *Circular Wait:* A set of processes are waiting for each other in circular form.
How switch works	A switch kicks off with an empty table that maps MAC address to the outgoing switch port. When a switch receives a packet at the first time, it adds the source MAC along with the port at which it received the packet to the switch table. As it doesn't have an entry for the destination MAC yet, it broadcasts that packet to all the devices connected in local network. Once the destined device responds, switch receives this packet and update the switch table. This is how switch updates its table and uses it to route packets to corresponding switch port.
ECMP algorithms	There are probably a dozen different ECMP algorithms. They also vary based on whether you are using Layer 2 or Layer 3. Fundamentally, <n> paths exist in the forward and reverse path direction. A modulo <n> hash of various header information is performed, and the output
Backup path	IGP pre-computes a backup path per primary path per IGP destination: per-path. The backup path is pre-installed in data plane. Upon local failure, all the backup paths of the impacted destinations are enabled in a prefix-independent manner (<50msec loss of connectivity) **pure backup path**　Backup path which is not ecmp **icmp backup path**　 Backup path which is ecmp **protected path**　　　 is a active path which has backup path **LFA**　　　　　　　　 When backup path are directly connected **RLFA(P,Q node)**　　 When backup path are not directly connected ,packet will 　　　　　　　　　　 be encapsulated till it reaches p,q router **TILfA**　　　　　　　　 When backup path are not directly connected when 　　　　　　　　　 P and q are disjoint
DMA	Direct Memory is a feature which provides direct access (read/write) to system memory without interaction from the CPU. using "DMA Controller"
STACK protection	in a multi-threaded environment, there can be multiple stacks in a process. One threat to the stack is malicious program input, which can overflow a buffer and overwrite stack pointers, simple method GCC, you use -fstack-protector-all.

Routing protocols	BGP is the core routing protocol of the Internet."When a BGP router first comes up on the Internet, it does is download the entire routing table of each neighboring router. After that it only exchanges much shorter update messages
Virtualization	With VMs, the hardware is being virtualized to run multiple OS instances. Docker is an open source project that makes it easier to create, deploy and run applications.in containers The applications are packaged in a docker container which contains all the dependencies (libraries, packages) that are needed to deploy the application. By using docker, an application can be easily moved around from the developer's laptop, into the testing environment and finally into production. . **Kubernetes pods** :A Kubernetes pod is a group of containers that are deployed together on the same host. If you frequently deploy single container s, you can generally replace the word "pod" with "container" and accurately understand the concept. **Docker** is a run time engine running on your computer. It's a daemon that is in charge of containers start, stop on that single computer. So Docker is about managing works within a single machine. **Kubernetes is kind of a cluster management software**. It is a group of daemons that is in charge of a cluster of machines. Though there is a single daemon (kubelet) running on an individual machine, the kubelet by itself does not have much value on the table; it is these group of kubelets (along with kubernetes controllers that control them) make decisions about the whole cluster. So k8s is about managing works for a cluster of machines.
Load balancing	**layer 3** load-balancer takes routing decisions based on IP alone (source & dest) **layer 4** load-balancer takes routing decision based on IPs **and** TCP or UDP ports. **Layer 7** load balancer operates at the high-level *application* layer, which deals with the actual content of each message.Layer 7 load balancing is more CPU-intensive rarely cause
Machine learning	Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. In **Supervised** learning, you train the machine using data which is well "labeled. **Unsupervised** learning is where you only have input data and no corresponding output variables. -
Intent-based networking	Intent-based networking, or IBN, uses advanced algorithms, AI-ML and network orchestration to make your enterprise network smarter. But with IBN, an intent

	can automatically be interpreted and applied throughout the network using GUI
Incognito mode	Incognito mode (Chrome), InPrivate (IE & Edge), Private Window (Firefox) Assume that you are going to an internet cafe to look up your mail. Incognito mode doesn't save passwords, cookies and your browsing history. So it is safe to use incognito mode if you are using some stranger's system.
Libvert	libvirt is an open-source API, daemon and management tool for managing platform virtualization. It can be used to manage KVM, Xen, VMware ESXi, QEMU and other virtualization technologies. These APIs are widely used in the Orchestration layer of hypervisors in the development of a cloud-based solution.
macro	1. Macros are expanded by the preprocessor before compilation takes place. 2. The compiler decides which functions to inline. 3. The advantage of using macro is the execution speed 4. The disadvantage of the macro is the size of the program.
Anycast	**Unicast** is one-to-one. **Broadcast** is one-to-many. It only works on a local network. **Multicast** is more complicated. It's one-to-many, but it can go outside a local network - even across the internet **Anycast** is a special case of unicast, as if you wrote a take-out order to "McDonalds, New York" and the letter carrier just delivered it to the first one he saw because they all had the same address. It's one-to-one, you just don't know or care which one
Penultimate hop popping (PHP)	PHP is penultimate hop popping which means remove the label one hop before its destination. It refers to the process whereby the outermost label of an MPLS tagged packet is removed by a Label Switch Router (LSR) before the packet is passed to an adjacent Label Edge Router. The process is important in a Layer 3 MPLS VPN environment as it reduces the load on the LER. If this process didn't happen, the LER would have to perform at least 2 label lookups: Both implicit and explicit null labels are generated by last hop router to its neighbors. **Implicit null is** by default which means penultimate router should only send IP packet thus it pops the label The one disadvantage in implicit null approach is if the network is configured for QoS based on MPLS EXP bits, then QoS is lost between penultimate router and last hop router. In this case, we can make use **of Explicit null** which means penultimate hop router does not pop the label. It sends with label value of 0 but with other fields including EXP bits intact. This way QoS treatment is preserved between penultimate router and last hop router. Explicit null should be configured manually in last hop router**.**

BFD	BFD is a network protocol that is used to detect failures in the link between two connected devices. BFD enables a session between the two ends of link, by a simple authentication Packets are transmitted at regular intervals. If the packets do not turn up, it indicates that the link has failed. The time intervals can be configured Although reducing the EIGRP, IS-IS, and OSPF timers can result in minimum detection timer of one to two seconds, BFD can provide failure detection in less than one second.
Pseudowire	Pseudowire (PW) is an emulation of a Point to Point wired connection (E1/T1) overMultiprotocol Label Switching (MPLS) cores.
VXLAN	VXLAN is essentially a **tunneling technology.** VXLAN adds the VXLAN header to an original data frame, encapsulates the frame into a UDP packet, and forwards the UDP packet in traditional IP network transmission mode. After the UDP packet arrives at the end point, the end point removes the outer header and sends the original data frame to the target terminal.
NOP	NOP can be used in early board development. Need to know clock speed
Relational Database	A transaction can be defined as a group of tasks. A single task is the minimum processing unit which cannot be divided further. Let's take an example of a simple transaction. Suppose a bank employee transfers Rs 500 from A's account to B's account. 1. taskTake money from A count 2. taktransfer to B account 3. task to pay transaction fees Relational databases like Microsoft's SQL Server use locks (DELETE, INSERT and UPDATE)to prevent multiple users from making conflicting modifications to a set of data: when a set of data is lockedby a user, no other users can modify that same set of data until the first user finishes modifying the data and relinquishes the lock.
Puzzles	Q1)There are three boxes, one contains only apples, one contains only oranges, and one contains both apples and oranges. The boxes have been incorrectly labeled such that no label identifies the actual contents of its box. Opening just one box, and without looking in the box, you take out one piece of fruit. By looking at the fruit, how can you immediately label all of the boxes correctly? Q2)You have a 3-gallon jug and 5-gallon jug measure exactly 4 gallons? Q3)If you look at the clock and the time is 3:15, what is the angle between the hours and the minutes hands? The minute hand travels 6° per minute and the hour hand travels 0.5° per minute

	At 3:15, the minute hand would have effectively travelled for 15 minutes covering (15 * 6 = 90°) after completing three full revolutions in three hours with net ZERO displacement from reference point. The Hour hand would have travelled for 180 + 15 = 195 minutes. It covers an angle of 195 x 0.5 = 97.5° The angle between the two hands now is 97.5°-90°=7.5° 12 <mark>persons 66 handshakes</mark> Let the number of persons= n Number of handshakes by first person= n minus 1, (As he cannot handshake with himself) Number of handshakes by second person = n minus 2 (As he has already handshake with first person) N(n-1)/2 =66

<mark>**Managed timer**</mark>	Managed timer is a component in IOX that is responsible for maintaining timers and firing them within the appropriate precision limits
	
	issues:
	1 Insertions into the linked list are expensive O(n) because the list is maintained sorted and the list can potentially grow upto 50,000 nodes.
	2 This is currently very CPU intensive and hence degrades the overall system performance.
	3 how to handle jitter
	4 timers that can be grouped and fired together are not done so
	5 Low insertion and deletion time – O(1) because of the sorted nature.
	
	Managed timer is a library that is responsible for maintaining timers and firing them within the appropriate precision. At a given moment only 1 timer (root node) will be programmed in kernel using timer_settime API. example the parent has the lowest value of the timer of its leaf nodes (1 min, 2 min, 3 min) so parent and root both will be 1 minutes
	
	  1. Talk about performance comparisons of using one data structure over another.
	  2. Design for backwards compatibility
	  3. Having to support a poorly designed and written legacy system.
	  4. redundant code in an outdated and obscure language with an awful design.
	
	Both single and multi-level hash tables were considered. A lot of reordering was required with every insert and delete operation. The data ranges could not be determined dynamically and s only fixed ranges can be supported. Since not all timers follow the same range set as well, i.e. timers right from milliseconds to a few hours exist and are not evenly distributed;
	
	Binary Trees: The problem with complete binary trees is the amount of reordering required in order to maintain the balance of the tree. This can take O(log n) operations for both inserts an deletes which is not desired.

<mark>Password less SSH</mark>	if you interact regularly with SSH commands and remote hosts, you may find that using a key pair instead of passwords can be convenient. Instead of the remote system prompting for a password with each connection, authentication can be automatically negotiated using a public and private key pair. The private key remains secure on your own workstation, and the public key gets placed in a specific location on each remote system that you access. A local caching program such as ssh-agent or gnome-keyring allows you to enter that passphrase periodically

	instead of each time you use the key to access a remote system. if password authentication is currently enabled, then the easiest way to transfer the public key to the remote host is with the ssh-copy-id command . Popular asymmetric encryption algorithms are RSA, Diffie-Hellman, ElGamal, and ECC
CA	**How does a company get a certificate?** Website owner first generates a public key and private key, keeping the private key secret. He gives a *Certificate Signing Request file (CSR)* and his *public key* to the CA. CA then creates a personal certificate based on CSR including domain name, owner name, expiry date, serial no. etc and also adds an **encrypted text** (= **digital signature**) to the certificate and finally encrypts the whole certificate with the public key of the server and sends it back to the website owner. This certificate is then decrypted with the private key of the website owner and finally, he installs it on the website. Who are CA's (Certificate Authorities)? CA's are globally trusted companies like GoDaddy, GeoTrust, VeriSign etc who provide digital certificates to the websites?
Microservices	The term "microservices" is generally meant to describe an approach to software development that involves de-composing application functionality into **individual components that can be deployed separately from** each other, and typically communicate via application programming interfaces or APIs. Common characteristics of microservices: • Support HTTP/REST protocols • Implement JSON or XML format for data exchange • Deployed via a containerization framework, such as Docker • Dynamically scaled on public or private cloud infrastructure • Often use noSQL or microSQL or key value stores to persist data Cons of microservices As microservices heavily rely on messaging, they can face certain problems.
Hyperconvergence	Converged infrastructure involves a preconfigured package of software and hardware in a single system for simplified management.
How ssl work	The client sends a "client hello" message. This includes the client's SSL version number, cipher settings, session-specific data and other information that the server needs to communicate with the client using SSL. The server responds with a "server hello" message. This includes the server's SSL version number, cipher settings, session-specific data, an SSL certificate with a public key and other information that the client needs to communicate with the server over SSL. The client verifies the server's SSL certificate from CA (Certificate Authority) and authenticates the server.

	Note SSL/TLS port is typically 443 .. Digital certificates is created by CA has metadata like public key ,domain name expiry date
<mark>Digital Signing</mark>	Digital Signature is a process that guarantees that the contents of a message Have not been altered in transit. When you, the server, digitally sign a document, you add a one-way hash (encryption) of the message content using your private key . The recipient will recreate the message hash, decrypts the encrypted hash using your well-known public key stored in your signed certificate, check that both hashes are equals and finally check the certificate.
<mark>Python</mark>	1. Normal recommendations is to use 4 spaces 2. Python 3, the print statement has been replaced with a print () function. 3. lists are defined by having quoted values comma separated inside square brackets [ ] 4. In Python dictionaries are written with curly brackets, and they are having quoted ke and quoted values seprated by colons 5. the items of a dictionary by referring to its key name, inside square brackets: Writing user-defined functions in Python. ... Declare the function with the keyword def followed by function name arguments and colon. def function (argument) colon add 4 space and do action return; A lambda function is a small anonymous function. A lambda function can take any number of arguments but can only have one expression. Example vishal = lambda a comma b colon a plus b print(vishal 20 comma 30)) Variables are containers for storing data values x=5 To create a class, use the keyword class: RegEx in Python import re x = re.search (pattern ,input)
<mark>Dijkstra's Algorithm?</mark>	Dijkstra's algorithm is a step-by-step process we can use to find the shortest path between two vertices in a weighted graph **.** 1. Pick first node and calculate distances to adjacent nodes. 2. Pick next node with minimal distance; repeat adjacent node distance calculations. 3. Final result of shortest-path tree. What are advantage and disadvantage of Dijkstra's Algorithm? 1) It is used in Google Maps 2) ospf

	Disadvantages: - The major disadvantage of the algorithm is the fact that it does a blind search there by consuming a lot of time waste of necessary resources. Another disadvantage is that it cannot handle negative edges. This leads to acyclic graphs and most often cannot obtain the right shortest path
Apache Kafka	Kafka is a distributed messaging system providing fast, highly scalable and redundant Messaging through a publish-subscribe model. Kafka's distributed design gives it several advantages. First,Kafka allows many permanent or ad-hoc consumers. Second, Kafka is highly available and resilient to node failures and supports automatic recovery. All incoming data is first placed in Kafka and all outgoing data is read from Kafka. Kafka is developed at LinkedIn and later it became a part of Apache Project The most important elements of Kafka are as follows: Topic is a category or feed name to which records are published. Topics in Kafka are always multi-subscriber; i.e., a topic can have zero, one, or many consumers that can subscribe to the topic and consume the data written to it. You have sales records getting published in sales topic, product records getting published in product topic and so on This will actually segregate your messages and the consumers will only subscribe to the topic which they need. Kafka topics are divided into a number of partitions. Partitions allow you to parallelize a topic So, in case of sales topic, you can have 3 partitions, from where three consumers can read data parallelly. Producers publishes the data to the topics of their choice. Consumers can subscribe to one or more topic and consumes data from that topic. Consumers label themselves with a consumer group name. Each record published to a topic is delivered to one consumer instance within each subscribing consumer group. But you can have multiple consumer groups which can subscribe to a topic, where one record can be consumed by as multiple consumers, i.e. one consumer from each consumer group. Consumer instances can be in separate processes or on separate machines. Broker is a single machine in the Kafka Cluster. Zookeeper is another apache open source proje information related to Kafka cluster like brokers information, topics details etc
Artificial intelligence	In Supervised learning, you train the machine using data which is well "labeled. .Supervised learning model takes direct feedback to check if it is predicting correct output or not. Regression: This type can be used when the output variable is a real or continuous value. For example, salary based on work experience, or weight based on height, etc. Classification: To find whether an email received is a spam or ham To identify customer segments To find if a bank loan is granted To identify if a kid will pass or fail in an examination

	Decision Tree: find out if a person is fit or not. Based on a series of test conditions, **Random Forest** : A random forest, is making a bunch of decision trees, and consulting all of them at once to make your decision. Let's say you had to make a big life decision, and yo knew it came down to some factors: Health, happiness, finances, philosophy And different factors have different importance's: **Naive Bayes** : assumes that the presence of a particular feature in a class is unrelated to the presence of any other feature. For example, a fruit may be considered to be an apple if it is red, round, and about 3 inches in diameter. **Unsupervised learning** is where you only have input data and no corresponding output Variable .The machine works by searching a pattern in the unlabeled data and then responds. The goal of unsupervised learning is to find the hidden patterns and useful insights from the unknown dataset. **Clustering**: In clustering, objects are divided into clusters that are similar but are dissimilar to the objects belonging to another cluster. Like, finding out which customers made similar product purchases. **Association: As** the name suggests, it discovers the probability of the co-occurrence of items ir Collection.

Amazon Web Services (AWS)	Amazon Web Services (AWS) is a secure cloud services platform, offering compute power, database storage, content delivery and other functionality to help businesses scale and grow.
	
	 Basic Terminologies
	    1. Region — A region is a geographical area. Each region consists of 2 (or more) availability zones.
	 2. Availability Zone — It is simply a data center.
	 3. **IAM (Identity and Access Management)** — Allows you to manage users, assign policies, create groups to manage multiple users.
	
	 Compute
	    1. **EC2 (Elastic Compute Cloud)** — These are just the virtual machines in the Cloud on which you have the OS level control. You can run whatever you want in them.
	    2. **ECS (Elastic Container Service)** — It is a highly scalable container service to allows You to run Docker containers in the cloud.
	    3. **Lambda** — AWS's serverless technology that allows you to run functions in the cloud.
	    4. **Elastic Beanstalk —** Allows automated deployment and provisioning of resources like a highly scalable production website
	
	 storage
	 S3 (Simple Storage Service) — it uses Buckets (folders) and keys (files).
	 Storage service of AWS in which we can store objects like files, folders, images, documents,
	 Amazon Web Service S3 is basically a simple storage service that stores all the images, files,

	data etc. Just like folders and files in Windows . **Glacier** — It is an extremely low-cost archival service to store files for a long time like a few ye **Storage Gateway** — It is a virtual machine that you install on your on-premise servers. Your on-premise data can be backed up to AWS providing more durability **CloudSearch** — It can be used to create a fully managed **search engine** for your website. <mark>**Amazon Virtual Private Cloud (Amazon VPC) lets**</mark> you provision a logically isolated section of the AWS Cloud where you can launch AWS resources in a virtual network that you define. The public cloud provider is responsible for ensuring that each private cloud customer's data remains isolated from every other customer's data both in transit and inside the cloud provide network. This can be accomplished through the use of security policies requiring some -- or all -- of the following elements: encryption, tunneling, private IP addressing or allocating a unique VLAN to each customer. For example, you can create a public-facing subnet for your web servers that have access to t internet. You can also place your backend systems, such as databases or application servers, i subnet with no internet access.
<mark>IGMP snooping</mark>	IGMP snooping is the process of listening to Internet Group Management Protocol (IGMP) network traffic. The feature allows a network switch to listen in on the IGMP conversation between hosts and routers. By listening to these conversations, the switch maintains a map of which links need which IP multicast streams. Multicasts may be filtered from the links which do not need them and thus controls which ports receive specific multicast traffic. The benefit is that multicast traffic goes only where it belongs. If nothing on that port has join that group, the switch will prune it. In a cascaded environment, that can significantly reduce inter-switch traffic. And likewise keep access links clear of traffic hosts don't want.
<mark>DNS server</mark>	DNS is organized in a hierarchy that helps keep things running quickly and smoothly. DNS information is shared among many servers but is also cached locally on client computer The initial request for the IP address is made to a recursive resolver, a server that is usually operated by an ISP or other third-party provider. The recursive resolver knows which other DNS servers it needs to ask to resolve the name of a site (networkworld.com) with its IP address. This search leads to a root server, which knows all the information about top-level domains, such as .com, .net, .org and all of those country domains like .cn (China) and .uk (United Kingdom). Root servers are located all around the world, so the system usually directs you to the closest one geographically. Once the request reaches the correct ro server, it goes to a top-level domain (TLD) name server, which stores the information for the second-level domain, the words used before you get to the .com, .org, .net (for example, that information for networkworld.com is "networkworld"). The request then goes to the Domain Name Server, which holds the information about the site and its IP address. Once the IP addre is discovered, it is sent back to the client, which can now use it to visit the website. All of this takes mere milliseconds.
<mark>(DNS) spoofing</mark>	Domain Name Server (DNS) spoofing (a.k.a. DNS cache poisoning) is an attack in which altered DNS records are used to redirect online traffic to a fraudulent website that resembles its intended destination. DNSSEC is a protocol designed to secure your DNS by adding additional methods of verification.The protocol creates a unique cryptographic signature stored alongside your other DNS recordsThis signature is then used by your DNS resolver to authenticate a DNS response, ensuring that the record wasn't tampered with.

	The Cisco Product Security Incident Response Team (PSIRT) is a dedicated, global team that manages the receipt, investigation, and public reporting of security vulnerability information that is related Cisco products and networks.
	CVE, short for Common Vulnerabilities and Exposures
	address Resolution Protocol (ARP) is used to map a known IP Address to a unkown data-link identifier (for example MAC Address) By default Cisco Routers holds the ARP entries for 4 hours. You can change this value per interface basis with the command: arp timeout <value in seconds>. Example: **Proxy ARP** A Proxy ARP enabled Router answers ARP requests intended for another machine, it does that by making the local host believe that the Router is the "owner" of that IP Address, local host will forward the traffic to the Router and the Router will be responsible to "route" the packets to the real destination. **Gratuitous ARP** In some circumstances a Host (Router, Switch, Computer, etc) might send an ARP Request with it´s own address as the target address... But, to his own address?! Why a host would do that!? Well... there are some reasons... for example: •It´s use to update other devices ARP Table (when a device receives an ARP Request with an IP that it´s already in it´s cache, the cache will be updated with the new information; •HSRP Routers that takes over the control will send Gratuitous ARP out the network to update the cache table of other devices ; •To check for duplicate addresses (if the host receives a response, it´ll know that somebody is using the same IP Address). You can check this Gratuitous ARP traffic captured with Wireshark (the best opensource sniffer out there): **RARP** is the opposite of ARP, it maps an IPv4 Address to a know MAC Address, for example, old workstations (dumb terminals) could have it´s firmware programmed to send a RARP request as soon as it was powered up, and a RARP Server would answer this RARP request with the workstation´s IP Address (Airline Companies used it ALOT in the past). Hmmm.. looks like DHCP right?! Yeah.. it looks, but it ISN´T ok?! ;)
	basic routing table includes the following information: •Destination: The IP address of the packet's final destination •Next hop: The IP address to which the packet is forwarded •Interface: The outgoing network interface the device should use when forwarding the packet •Metric: Assigns a cost to each available route so that the most cost-effective path can be cho •Routes: Includes directly-attached subnets, indirect subnets that are not attached to the devi