Please read the following ethical statement. If it is true, please enter your name in the answer box below.

I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination. I further pledge that I have not referred to or copied any material from another student, a book, article, the Internet or any other source during this exam. I further pledge that I have not downloaded this exam or have saved a copy of this exam in any form.

Your Answer:

Kanika Adik

**Question 2**

**6 / 6 pts**

What is “source routing” in IP? Please describe. **(4 points)** In addition, identify one application for source routing. **(2 points)**

Your Answer:

Source Routing is defining the path using which the packets are to be routed. This is defined at the source from where the data is transmitted.

The packet moves forward based on the destination address and the route chosen by the sender, source routing defines the routing path. It is usually not dependent on internally linked routers and routing tables to define its path from source to destination. The hops within a network are predefined and follow the exact same path towards the destination.

Application of source routing - where there is no routing table required. Within a LAN/ VLAN

**Question 3**

**6 / 6 pts**

Why does the Internet Protocol limit the “lifetime” of a packet in the Internet? Please be specific. **(6 points)**

Your Answer:

Internet Protocol limit the lifetime of a packet in the internet using TTL bit i.e. Time To Live.   
When a packet starts its journey from source to destination it passes through multiple routers and path to reach the destination. In this process it moves from more than one router as source router to the destination router with multiple hops within the network.   
During this hop it could lose its path and get lost within the network if the destination is far at distance within the network if it is lost, it may keep on travelling within the network without a proper destination to reach, hence itt would create more congestion within the network. To avoid the 'Loop' within the network the packet in Internet has TTL which is a kind of counter set and reduced at each hop taking place within the network.  
  
Hence the IP limit the lifetime of a packet to avoid looping of the packet within the network and avoid unnecessary packet looping that could lead to congestion.

**Question 4**

**10 / 10 pts**

An IPv4 packet is to be transmitted over an Ethernet LAN. The maximum size of the data field in the Ethernet frame is 1500 octets. (i.e. The MTU for Ethernet is 1500 octets). The total length of the IPv4 packet is 5,500 octets. (This includes the length of the IPv4 header). The length of the IPv4 header is the minimum allowable length. Determine the minimum number of fragments the original IPv4 packet must be fragmented into for transmission over the Ethernet LAN. In addition, for each fragment, determine the value of the “Fragment Offset” field in the fragment header. (Assume the minimum size IP header in each fragment). **(10 points)**

Your Answer:

Maximum data size - 1500 octets (MTU)

Total length of data - 5500 octets (header inclusive i.e. 20 octets) Length of IPV4 header - minimum allowed length i.e. 20 octets

Hence if we plan to send 5500 octets in 4 sizes

5500/4 =1375 (since divided by 3 goes beyond mtu limit of 1500)

adjusting upto maximum of 1500 octect size i.e 1480

1500- 20(ip header size) - 1480 of octets

for last fragment - 1480 \*3 - 4440 - 5500= 1060 - 20(ip header) = 1040 (last fragmen length)

Minimum no of fragments ipv4 must be fragmented - 4 and transmitted as per MTU - 1500,  as follows

|  |  |  |
| --- | --- | --- |
| **fragment no** | **fragment length** | **Fragment Offset** |
| **1** | **1480** | **0** |
| **2** | **1480** | **185** |
| **3** | **1480** | **370** |
| **4** | **1040** | **555** |

**Question 5**

**10 / 10 pts**

You are given the following Class C address; 219.23.7.0. Your network configuration is required to support 5 subnets (LANs).

a. Determine the maximum number of users (or “hosts”) allowable per subnet. **(5 points)**

b. Determine the subnet mask. **(5 points)**

Your Answer:

Class C Address - 219.23.7.0

Network configuration to support 5 subnets

A. Max no of users hosts allowed per subnet --

In order to support 5 subnets for Class C we need to borrow 3 bits from host

hence total subnets will be vailable as - 2^3 =  8 out of which 5 subnets can be used  3 will be unused or wasted

and there will be total-- 2^5(bits of hosts) -2 = **30 hosts allowed per subnet**

B. Default Subnet mask for Class C is -- 255.255.255.0

for this case subnet mask will be -**255.255.255.224**

**Question 6**

**6 / 6 pts**

What is the role (or function) of the Internet Control Message Protocol (ICMP)? **(6 points)**

Your Answer:

ICMP is Internet Control Message Protocol. As the name suggests it is a control protocol which helps to keep a check on Error Message within the network. It provides means of communicating error msgs within the routers and hosts for smoother communication. It also provides feedback of any issues. This is a layer 3 protocol.

* If the destination is running out buffer space
* the destination is not reachable
* the TTL is expired
* if the redirection is applied
* Timestamp and reply addresses mask requests and reply

**Question 7**

**6 / 6 pts**

What is the role (or function) of the Address Resolution Protocol (ARP)? **(6 points)**

Your Answer:

Address Resolution Protocol- is a broadcast protocol that helps in knowing the MAC Address of a device/ ethernet.

* In sending information from source to destination, there is IP Address allotment within the connected network of two devices
* If the source / sender device is unaware of a destination device's MAC address it does not help to send the data
* Once the sender sends a ARP Packet with its own MAC and destination IP address over the network,
* the ARP broadcast the destination IP Address in the network
* The destination Address identifies its IP address and responds with its own MAC Address
* Hence the source receives the MAC Address of  the destination.   
    
  This way the source registers the MAC Address of the destination to communicate and share information within the network. Hence ARP helps to resolve the Destination MAC Address if it is not identified.

**Question 8**

**6 / 6 pts**

What is the role (or function) of the Flow Label in IPv6? (How is the Flow Label used in IPv6?) **(6 points)**

Your Answer:

Flow Label in IPv6 - is used to maintain a consistent flow between source and destination

* a sequence should belong to same identifier or flow/ stream
* this helps to stream packets belonging to same flow or stream to maintain constant QoS
* in IPV6 this has 128 bit expanded address space
* It has  to label the packet flow
* this is improved option mechanism in IPv6
* It has request for common numbers
* The IPV6 flow label is related sequnece of packets which helps in special handling of the the data
* it is identified by source and destination address  with flow label
* the router treats flow differently it is considered alternaive to including information in the headers
* it has request on flow label processing.
* IPV6 has this advantage over IPV4 in maintining consistent performance with flow labeling

**Question 9**

**5 / 10 pts**

Consider a TCP exchange between Machine A and Machine B. Machine A sends a TCP message with the following in the TCP header; SEQUENCE = 1250, ACK = 690, and WINDOW = 140. This TCP message from Machine A to Machine B contains 300 octets of data. Machine B replies with a TCP message which contains 140 octets of data. What is the value of SEQUENCE and ACK in the message from Machine B to Machine A? (NOTE: Label your answers; SEQUENCE = , ACK = ) **(5 points each; 10 points total)**

Your Answer:

Machine A sends -

SEQUENCE = 1250, ACK = 690,  WINDOW = 140.

contains 300 octets of data

Machine B replies-

140 octets of data

next sequence starts -- 1250+140 - 1390 ,**hence ACK - 1390**

and **seq sent by B - 690 since Machine A ACK is 690**

**SEQUENCE = 690  , ACK =1390**

Sequence = 690 Ack = 1550

**Question 10**

**5 / 5 pts**

What is the role (or function) of the Urgent Pointer field in the TCP header? (How is the Urgent Pointer field used in TCP?) **(5 points)**

Your Answer:

Urgent pointer helps to identify from where the Urgent data needs to be READ out FIRST.

URG flag helps to know the Urgent pointer data segment start location to read our First by the destination.

It helps to find out the critical data that is sent and required to be read out first value is equal to location of data sequence , Application is notified what data is urgent through urgent ointer

**Question 11**

**5 / 5 pts**

A server implementing TCP receives a TCP message with the “Push” flag set. What is the impact of receiving a TCP message with the Push flag set? (What is the impact on the delivery of the received message to the application when the Push flag is set?) **(5 points)**

Your Answer:

TCP with PUSH flag set -

* is a immediate message that needs to be sent by the network
* if the PSH is set to 1 it means thhe data packet is of highest importance and should be immediately pushed out to the network towards destination
* it is a kind of notifier which tells to not to Wait and send data to send out in first place
* not to be delayed
* A PUSH Flag packet is Delivered with highest priority and at immediate action without any further delay
* When a Push flagged messgae is received it is understoood to be of utmost importance at the recieving end and must have soemthing very important that has been sent at that instance.

**Question 12**

**4 / 4 pts**

Identify two applications (other than VoIP) which use UDP. **(2 points each; 4 points total)**

Your Answer:

Applications of UDP-

* Real time multiplayer  games
* Zoom meeting
* streaming media/data

**Question 13**

**6 / 6 pts**

What is the advantage of connectionless operation in UDP compared to connection-oriented operation in TCP? **(6 points)**

Your Answer:

Advantages of connectionless  UDP-

* It helps to send data in faster means
* The data is sent regardless of receiver acknowledgment
* no interference of response packets, hence faster and better use of bandwidth
* There is no Connection establishment and then transfer of dtaa hence do not have to wait until the connection is established with the destination

**Question 14**

**5 / 5 pts**

Define an autonomous system (AS). **(5 points)**

Your Answer:

Autonomous system - is a System of routers within a network having same routing protocol implemented throughout. It is usually owned by a specific organisation

* Same routing algorithim used thoroughout the network
* Interrior routing protocol.
* It has UNIQUE ASN number by which it is identified
* Every decision made is applicable to all the routers within the system
* It is consistent throughout wrt routing protocol e.g. - User1 -> WLAN-> ISP-> BBN1-> BBN2 -> ISP -> WLAN-> User2  will consist of internal BBN1-BBN2 connectivity following same routing prototcol
* It uses interrior routing protocol like OSPF
* Mutltiple AS connected and are communicating with Exterior routing protocol called BGP

**Question 15**

**10 / 10 pts**

Discuss the important differences between distance-vector routing protocols and link-state routing protocols. **(10 points)**

Your Answer:

|  |  |
| --- | --- |
| **Distance Vector routing protocol** | **LinkState Routing Protocol** |
| Maintains a routing table information/ Vector table at each router | Each router maintains routing cost for every linked router within the network |
| it maintains aggregation information for each path | this is a non aggregated protocol |
| every node within the network has cost precalculated in the vector table | there is no precalculation done, but individual link cost to other router it is linked to |
| not that widely used | widely used |
| topology is hard to determine | helps to identify topology |
| each router communicates distance vector and cost to neighbouring routers | it has equal sharing or information every router to router |
| it follows the vector table list of router and its path cost | it mentions state of its link with a cost to other router nodes |
|  | if there is failure of a node/ link the cost goes to infinity |

**Question 16**

**5 / 5 pts**

Identify and discuss the important difference(s) between OSPF and (exterior) BGP routing protocols. **(5 points)**

Your Answer:

|  |  |
| --- | --- |
| OSPF | BGP routing |
| OSPF is open shortest path first protocol | BGP is a brodcast Gateway protocol |
| this is interior routing protocol | This is exterior routing protocol |
| operates within ASN | Operates outside of an ASNs |
| This is fully meshed network hence will be more complex | Has two types Internal BGP & Exterior BGP |
| It maintains routing table with distance costs within next hops, helps to find the minimum hop within network | it has msgs sent out -  OPEN, KEEPALIVE,  UPDATE, NOTIFICATION |
| OSPF Floods the network | BGP is a brodcast Gateway protocol |