Question 1.

A network communication service known as a "connectionless service" does not create a specific communication path between the sender and the receiver. The sender of a message delivers it through connectionless unacknowledged service, commonly referred to as "fire and forget" without verifying that the recipient has received it. The message may or may not be received by the intended recipient, and the sender is not provided with a confirmation.

By contrast, the sender of a message using a "connectionless acknowledged service" waits for the recipient to confirm receipt before sending another message. If the communication is received, the recipient replies with an acknowledgment to the sender. The sender may conclude that the message was not received if they do not receive an acknowledgment.

Different protocols used to deliver these services handle packet loss and protocol overhead in different ways. The delivery of messages is not guaranteed by "connectionless unacknowledged service" protocols like UDP (User Datagram Protocol), despite their short weight and low overhead. Although they have higher overhead, connectionless acknowledged service protocols like ICMP (Internet Control Message Protocol) and ARP (Address Resolution Protocol), which provide acknowledgments of successful message delivery, offer improved reliability.

Question 2.

First, find out the probability of the k packets that have reached the T- second. It can be computed with the help of binomial distribution that has parameters as N = 60 and shows the probability of p = 0.1. The multiplexer has one line in which it can transmit eight packets every T seconds.

The average number for the arrivals of the packets can be given as Np=6. Now, calculate the average number of packets received through the first line as below:

Now, the average number of packets received is 4.59 that gets transmitted through the first line. The remaining will get transmitted by the second line. Now, the average number of packets transmitted through the second line per T second can be obtained as below:

Therefore, it will transmit 1.41 packets on average per T second from the second line.

Question 3

a. To allow for the exchange of messages of arbitrary size within the given constraints, the peer processes can use a technique known as segmentation and reassembly. This involves dividing a message into smaller segments, each of which can fit within a single PDU, and then sending these segments over multiple PDUs. The receiver can then reassemble the segments back into the original message.

b. The essential control information that needs to be exchanged between the peer processes includes:

Sequence numbers: These are used to ensure that all segments are received in the correct order and that no segments are missing or duplicated.

Acknowledgment numbers: These are used to confirm that a segment has been successfully received by the receiver.

Window sizes: These are used to allow the sender to adjust the number of unacknowledged segments it can send at any given time based on how much space is available in the receiver's buffer.

c. If the message transfer service is shared by several source-destination pairs, additional control information may be required to differentiate between the different messages being sent. This information could be placed in the header of each PDU and could include the source and destination addresses, session identifiers, or any other information needed to identify the specific message being sent. Additionally, the control information used to manage the flow of PDUs between the sender and receiver may also need to be adjusted to account for multiple concurrent connections. For example, each connection may require its own sequence and acknowledgment numbers to ensure that segments are properly tracked and acknowledged for each individual message.

Question 4

a, We define N is the node 4, D1, D2, D3, D5, D6 is the node 1, 2, 3, 5, 6.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Iteration | N | D1 | D2 | D3 | D5 | D6 |
| Initial | {N} | 5 | **1** | 2 | 3 | ~ |
| 1 | {N, D2} | 4, D2 |  | **2** | 3 | ~ |
| 2 | {N, D2, D3} | 4, D2 |  | - | **3** | **3, D3** |
| 3 | {N, D2, D3, D5, D6} | 4, D2 |  |  |  |  |
| 4 | {N, D2, D3, D5, D6, D1} | - | - | - | - | - |

So that, we can conclude that

+ The shortest part from N to D1 is 4, and pass D2.

+ The shortest part from N to D2 is 1.

+ The shortest part from N to D3 is 2.

+ The shortest part from N to D5 is 3.

+ The shortest part from N to D6 is 3, and pass D3.

b,

|  |  |  |
| --- | --- | --- |
| Destination | Cost | Next Hop |
| D1 | 4 | D2 |
| D2 | 1 | D2 |
| D3 | 2 | D3 |
| D5 | 3 | D5 |
| D6 | 3 | D3 |

Question 5.

Given:

Host IP Address: 192.168.200.139

Original Subnet Mask: 255.255.255.0

New Subnet Mask: 255.255.255.224

We'll first determine the number of subnet bits, the number of subnets created, the number of host bits per subnet, the number of hosts per subnet and the network address of this subnet. Here's how we do it:

A number of Subnet Bits:

Original Subnet Mask: 255.255.255.0 (CIDR /24)

New Subnet Mask: 255.255.255.224 (CIDR /27)

Number of Subnet Bits = New CIDR notation - Original CIDR notation = 27 - 24 = 3 subnet bits

Number of Subnets Created:

Number of Subnets = 2 ^ (Number of Subnet Bits) = 2 ^ 3 = 8 subnets

Number of Host Bits per Subnet:

Host Bits per Subnet = 32 - New CIDR notation = 32 - 27 = 5 host bits

Number of Hosts per Subnet:

Number of Hosts = 2 ^ (Host Bits per Subnet) - 2 = 2 ^ 5 - 2 = 30 hosts

Network Address of this Subnet:

Host IP Address: 192.168.200.139

New Subnet Mask: 255.255.255.224

To find the network address, perform a bitwise AND operation between the IP address and the new subnet mask:

192.168.200.139 = 11000000.10101000.11001000.10001011

AND

255.255.255.224 = 11111111.11111111.11111111.11100000

11000000.10101000.11001000.10000000 = 192.168.200.128

So, the network address of this subnet is 192.168.200.128

To find the IPv4 address of the first host, last host, and the broadcast address on this subnet, we'll use the network address and the number of hosts per subnet we calculated earlier.

Network Address: 192.168.200.128

Number of Hosts per Subnet: 30

IPv4 Address of First Host on this Subnet: Add 1 to the network address: 192.168.200.128 + 1 = 192.168.200.129

IPv4 Address of Last Host on this Subnet: Since there are 30 hosts per subnet, add 30 - 1 to the first host address:

192.168.200.128+ (30 - 1) = 192.168.200.157

IPv4 Broadcast Address on this Subnet: Add 1 to the last host address: 192.168.200.157+ 1 = 192.168.200.158

In summary:

IPv4 Address of First Host on this Subnet: 192.168.200.129

IPv4 Address of Last Host on this Subnet: 192.168.200.157

IPv4 Broadcast Address on this Subnet: 192.168.200.158

In summary,

|  |  |
| --- | --- |
| Number of Subnet Bits | 3 |
| Number of Subnet Created | 8 |
| Number of Host Bits per Subnet | 5 |
| Number of Hosts per Subnet | 30 |
| Network Address of this Subnet | 192.168.200.128 |
| Ipv4 Address of First Host on this Subnet | 192.168.200.129 |
| Ipv4 Address of Last Host on this Subnet | 192.168.200.157 |
| Ipv4 Broadcast Address on this Subnet | 192.168.200.158 |