Question Paper

SEP 2024 - UE22EC351A - ISA 1 (set- 1)

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1.a : Marks (4.0)

Suppose one of the HTTP messages observed between the client and the web server is as given below.

```
HTTP/1.1 200 OK
Connection: close
Date: Tue, 18 Aug 2015 15:44:04 GMT
Server: Apache/2.2.3 (CentOS)
Last-Modified: Tue, 18 Aug 2015 15:11:03 GMT
Content-Length: 6821
Content-Type: text/html

(data data data data data ...)
```

Answer the following questions.

1. Is this HTTP request message or HTTP response message? How can you tell?
2. Is the connection persistent or non-persistent? How can you tell?
3. When was the HTTP message created by the web server?

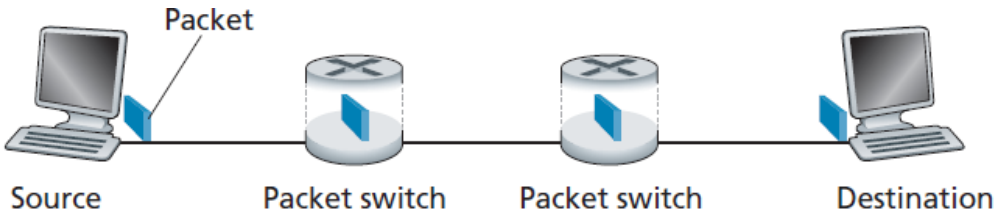
Expected Answer

1 mark each

1. It is a HTTP response message. The first line is the status line.
2. The connection is non-persistent as the header line Connection has the value "close".
3. The HTTP message was created by the web server at Tue, 18 Aug 2015 15:44:04 GMT.
4. The given version of the object became available on the web server at Tue

1.b : Marks (4.0)

Consider a message that is 10^6 bits long that is to be sent from source to destination as shown in the figure below.



Suppose each link in the figure is 5 Mbps. Ignore propagation, queuing, and processing delays. Let the message be segmented into 100 packets, with each packet being 10,000 bits long. Assume that there are no packet acknowledgements. Answer the following:

1. How long does it take to move the first packet from source host to the first

Expected Answer

Given: Only transmission delay is significant. Number of packets N=100, packet size L=10,000 bits and R=5 Mbps.

1. Assuming transmission of first packet starts at t = 0. The first packet reaches the first switch at t = L/R = 2 ms
2. Source starts transmission of second packet at t = L/R. The second packet reaches the first switch at t = 2 * L/R = 4 ms
3. The file transmission is completed when the 100th packet is received by

1.c : Marks (4.0)

Consider the interaction between a DHCP client and the DHCP server. Answer the following.

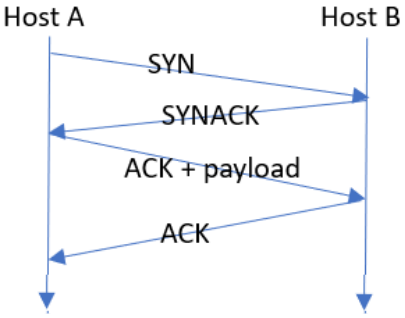
1. What are the various DHCP messages exchanged? List them in the correct order. ---------- 2 marks
2. What are the port numbers of the DHCP client and the DHCP server? ---------- 1 mark
3. What are the source IP address and destination IP address used in the

Expected Answer

1. DHCP discover message, DHCP offer message, DHCP request message and DHCP acknowledgement
2. DHCP client port number is 68 and DHCP server port number is 67
3. The source IP address and destination IP address used in the first DHCP message sent by the DHCP client are 0.0.0.0 and 255.255.255.255 respectively.

1.d : Marks (4.0)

Consider a TCP connection between hosts A and B. Suppose the initial sequence numbers chosen by hosts A and B are 199 and 499 respectively. Suppose host A successfully sends a TCP segment of length 1000 bytes to host B.



Answer the following.

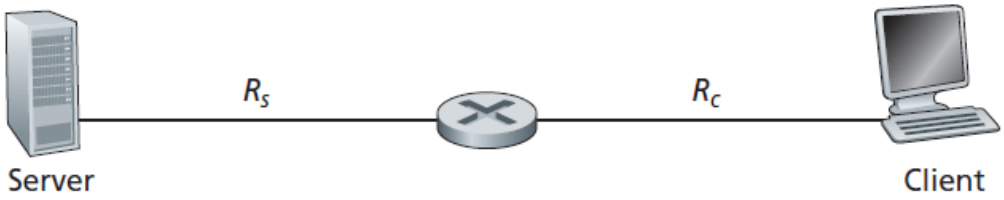
1. What will be the acknowledgement number in the SYNACK segment? ------ --- 1 mark
2. Suppose host A sends a payload of length 1000 bytes in the 3rd

Expected Answer

1. The acknowledgement number in the SYNACK segment is 200
2. The sequence number and acknowledgement number in the 3rd handshake segment are 200 and 500 respectively.
3. The acknowledgement number in the ACK segment returned by host B is 1200

5 : Marks (2.0)

Consider the connection given below. Let $R_C = 2\ Mbps$ and $R_S = 4\ Mbps$ Suppose we want to transfer a file of size $F = 15\ MB$ from the server to the client. What is the minimum time to transfer the file?



Expected Answer

Maximum throughput achieved is $min(R_S, R_C) = 2\ Mbps$

Therefore, the minumum time to transfer file of size 15 MB is approximately

$F / min(R_S, R_C) = 15 \times 10^6 \times 8 / 2 \times 10^6 = 60\ sec$

6 : Marks (2.0)

Assume that a host receives a UDP segment with 01011101 11110010 (we separated the values of each byte with a space for clarity) as the checksum. The host adds the 16-bit words over all necessary fields excluding the checksum and obtains the value 00110010 00001101. Is the segment considered correctly received or not? What does the receiver do?

Expected Answer

The sum of the checksum and the sum of all 16-bit words is 01111111 1111111. As the checksum is not all ones, the host detects packet error and discards the segment.

7 : Marks (2.0)

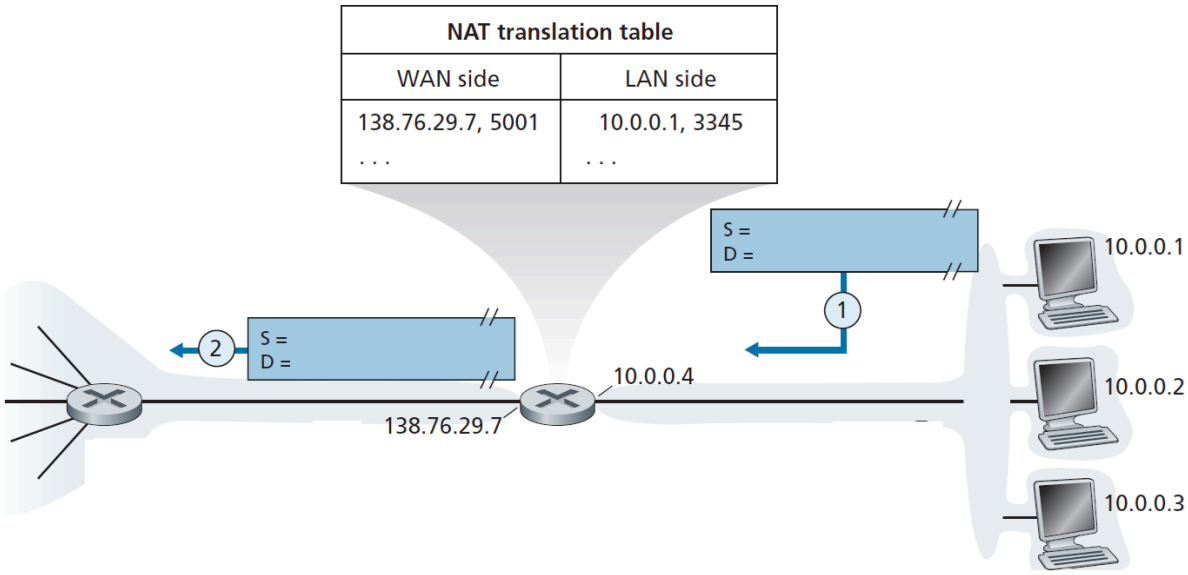
Consider the IPv4 address space 128.119.40.128/25, find the maximum number of subnets that can be created such that each one supports at least two IPv4 interfaces.

Expected Answer

Given prefix length of 25, we have 2^7=128 IP addresses. The smallest subnet that can be created can have 2^2=4 IP addresses. Therefore, we can create maximum of $2^7/2^2=2^5$=32 subnets.

8 : Marks (2.0)

Consider the communication between the host 10.0.0.1 and the web-server 128.119.40.186 via a NAT-enabled router as shown below.



What are the source IP address, destination IP address, source port number and destination port number for the following cases:

1. When the packet is propagating from the host to router (depicted as 1)

Expected Answer

The source IP address and source port number are replaced on the LAN side are replaced with the router's IP address and new port number 5001 on the WAN side.

9 : Marks (1.0)

When routers of an access ISP connect to routers of one or more regional ISPs, we call this interconnection as _____

Expected Answer

In a multi-home, the ISPs of a lower level connect with one or more ISPs at a higher level. The one from the higher level acts as the provider and the one from the higher level acts as the customer.

10 : Marks (1.0)

_____ protocol deals with moving a packet from one node (host or router) to the next node along the route between the source and destination.

Expected Answer

The link layer protocol moves datagram across a communication link connecting any two nodes (e.g., source and destination if hosts are directly connected or host and router when source and destination are multiple hops away)

11 : Marks (1.0)

The email message uses _____ protocol for moving messages from one mail server to the next.

Expected Answer

A client mail server sends mail messages over a TCP connection to the destination mail server using the SMTP.

12 : Marks (1.0)

Name the file used under DASH to convey the URLs of different video versions and their respective bit rates.

Expected Answer

The HTTP server sends the manifest file using which the HTTP client requests for chunks at a certain bit rate.

13 : Marks (1.0)

Suppose you want the name of the authoritative DNS server corresponding to a hostname. What should the "Type" field in the DNS query be?

Expected Answer

For an NS query, the Name field contains the hostname and the Value field contains the Authoritative DNS server name

14 : Marks (1.0)

Which delay depends on the traffic intensity experienced by a packet switch?

Expected Answer

When the traffic intensity increases, the queuing delay increases.

15 : Marks (1.0)

Which field in the UDP segment is used for error detection?

Expected Answer

Checksum is used for error detection at the receiver. This field is calculated at the sender for the entire segment plus the source IP address and destination address

16 : Marks (1.0)

Which of the following is not a header line in the HTTP request message?

Expected Answer

Last-Modified is a header line found in HTTP response message

17 : Marks (1.0)

The typical header length of a segment after establishing the TCP connection is _____ bytes.

Expected Answer

With "options" field absent in the TCP segments after connection establishment, the header length is 20 bytes.

18 : Marks (1.0)

Suppose a TCP segment goes unacknowledged, the TimeoutInterval for the subsequent segment _____

Expected Answer

TCP takes a conservative strategy and so doubles the TimeoutInterval when a segment is unacknowledged.

19 : Marks (1.0)

During slow start, the congestion window cwnd (expressed in MSS) increments by _____ for each segment acknowledged.

Expected Answer

For each segment acknowledged, cwnd increments by 1 in slow start and increments 1/cwnd in congestion avoidance.

20 : Marks (1.0)

The _____ flag is set when a host initiates closing the TCP connection.

Expected Answer

The FIN segment is transmitted by a host for closing the TCP connection, the ACK segment is sent in return for the FIN segment.

21 : Marks (1.0)

The field "Hop limit" in IPv6 datagram is similar to the _____ field in the IPv4 datagram.

Expected Answer

The TTL and Hop limit are similar. Both fields are decremented by 1 before a datagram is forwarded by the corresponding router.

22 : Marks (1.0)

Suppose a router is connected to the subnets 223.1.0.0/20, 223.1.16.0/20, 223.1.32.0/20 and 223.1.48.0/20. Apply route summarization to find the unique IPv4 address which can be advertised by the router instead of separately advertising the three subnets.

Expected Answer

Comparing the third decimal number of each subnet (i.e., 0000 0000, 0001 0000, 0010 0000 and 0011 0000) we see that up to the 18th bit, the prefix matches. Therefore, we get the aggregated network address as 223.1.0.0/18.

23 : Marks (1.0)

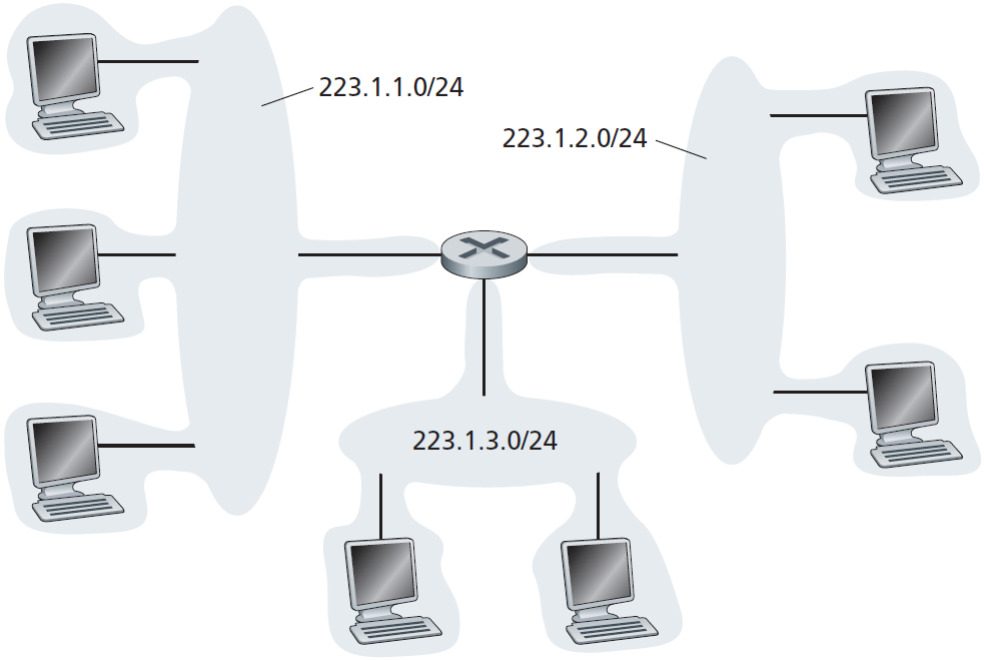
Which field in the IPv4 datagram deals with error detection?

Expected Answer

The sender inserts the checksum for the IPv4 header and the receiver verifies of the datagram is corrupt or not.

24 : Marks (1.0)

How many subnets are there in the figure given below?



Expected Answer

There are three unique prefixes in the network therefore, we have 3 subnets