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Course: GATE
Computer Science Engineering(CS)

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SINGLE SUBJECT : COMPUTER NETWORKS (GATE - 2019) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(33) | CORRECT(0) | INCORRECT(0) | SKIPPED(33)

Q. 1

Which of the following is not a class A host address?

Solution Video | Have any Doubt ?

A 128.4.5.6 — Correct Option

Solution :
(a)
Class A addresses are 0.0.0.0 to
127.255.255.255
So 128.4.5.6 is not a class A address.

B 117.4.5.1

C 117.0.0.0

D 117.8.0.0

QUESTION ANALYTICS +

Q. 2

Identify the correct sequence in which the following packets are transmitted on the network by a host when a browser requests a web page from a remote server, assuming that the host has just been restarted.

Solution Video | Have any Doubt ?

A HTTP GET request, DNS query, TCP SYN

B DNS query, HTTP GET request, TCP SYN

C DNS query, TCP SYN, HTTP GET request — Correct Option

Solution :
(c)
DNS query, TCP SYN, HTTP GET request.

D TCP SYN, DNS query, HTTP GET request

QUESTION ANALYTICS +

Q. 3

The reference polynomial used in a CRC scheme is $x^4 + x^3 + 1$. A data sequence 1010101010 is to be sent. Determine the actual bit string that is transmitted.

Solution Video | Have any Doubt ?

A 10101010100011

B 10101010101110

C 10101010100110

D 10101010100010 — Correct Option

Solution :
(d)
Reference polynomial $x^4 + x^3 + 1 = 11001$
Data sequence = 1010101010
On dividing 1010101010 by 11001,
We get CRC (i.e. remainder) = 0010
On appending this CRC on data sequence, we get the actual message transmitted i.e. 10101010100010.

QUESTION ANALYTICS +

Q. 4

If HLEN field of IP is 1111 then what is the length of header?

Solution Video | Have any Doubt ?

A 15

B 30

C 45

D 60 Correct Option

Solution :
(d)
HLEN × 4 = Header Size
15 × 4 = 60

QUESTION ANALYTICS +

Q. 5

Consider Bob uses an e-mail client (mail reader) such as Outlook to send an e-mail to Alice who uses a Web-based e-mail account (Gmail). The IP address of Alice's mail server is initially unknown to Bob's mail server. Which of the following is the correct sequence of activity for transport and application layer protocols that are involved from the time when Bob sends the e-mail to the time when Alice reads it?
S_1 : DNS over UDP is used by Bob's mail server to get the IP address for Alice's mail server.
S_2 : SMTP over TCP is used to transfer the mail from Bob's mail server to Alice's mail server.
S_3 : SMTP over TCP is used to transfer the mail from Bob's e-mail client to his SMTP server.
S_4 : HTTP over TCP is used by Alice to read this e-mail.

Solution Video | Have any Doubt ?

A S_1, S_2, S_3 and S_4

B S_1, S_3, S_2 and S_4

C S_3, S_1, S_2 and S_4 Correct Option

Solution :
(c)
1. SMTP over TCP is used to transfer the mail from Bobs e-mail client to his SMTP server.
2. DNS over UDP is used by Bob's mail server to get the IP address for Alice's mail server.
3. SMTP over TCP is used to transfer the mail from Bob's mail server to Alice's mail server.
4. Finally HTTP over TCP is used by Alice to read this e-mail.

D S_3, S_2, S_1 and S_4

QUESTION ANALYTICS +

Q. 6

Which of the following system call adds the local socket address to an already created socket?

Solution Video | Have any Doubt ?

A listen

B create

C bind Correct Option

Solution :
(c)
The bind( ) system call is used to associate a local address with a already created socket.

D connect

QUESTION ANALYTICS +

Q. 7

Which protocol uses a connection-oriented service to deliver files between end systems?

Solution Video | Have any Doubt ?

A TFTP

B DNS

C FTP Correct Option

Solution :
(c)
FTP depends on TCP, is connection oriented, and provides reliable control i.e. FTP has two connection one for sending data and one for Sending control signal.

D SNMP

QUESTION ANALYTICS +

Q. 8

Which of the following statements is true about Binary exponential backoff, a mechanism used in MAC protocols?

Solution Video | Have any Doubt ?

A It ensures that two or more nodes that experience a collision in a time slot will experience a lower probability of colliding with each there when they each retry that packet. Correct Option

Solution :
(a)
It ensures that two or more nodes that experience a collision in a time slot will experience a lower probability of colliding with each there when they each retry that packet.

B It ensures that two nodes that experience a collision in a time slot will never collide with each other when they each retry that packet

C It can be used with slotted Aloha but not with carrier sense multiple access.

D It improves the fairness of the throughput achieved by different nodes compared to not using the mechanism over a short period of time.

QUESTION ANALYTICS

Q. 9

Which of the timer is responsible for keeping the window size information flowing even if the other end closes its receiver window?

Solution Video | Have any Doubt ?

A Retransmission timer

B Persistent timer — Correct Option

Solution :
(b)
(b)
1. A retransmission timer is used when expecting an acknowledgment from the other end.
2. A persistent timer keeps window size information flowing even if the other end closes its receiver window.
3. A keep alive timer detects when the other end on an otherwise idle connection crashes or reboots.
4. A 2MSL timer measures the time a connection has been in the TIME_WAIT state.

C Keep alive timer

D Time-wait timer

QUESTION ANALYTICS

Q. 10

Consider a 10 km long broadcast LAN has 10^{10} bps bandwidth and uses CSMA/CD. The signal travels along the wire at 2.5×10^8 m/s. What is the minimum packet size that can be used on this network?

Solution Video | Have any Doubt ?

A 10^6 bits

B 10^7 bytes

C 10^4 bits

D 10^5 bytes — Correct Option

Solution :
(d)

$$\text{Minimum packet size} = \frac{(2 \times \text{Distance} \times \text{Bandwidth})}{\text{Velocity}}$$

$$\text{distance} = 10 \text{ km}$$
$$\text{Velocity} = 2.5 \times 10^8 \text{ m/s}$$
$$\text{Bandwidth} = 10^{10} \text{ bps}$$

$$\text{Minimum packet size} = \frac{(2 \times 10 \times 10^3 \times 10^{10})}{(2.5 \times 10^8) \text{ bits}}$$

$$= 8 \times 10^5 \text{ bits} = 10^5 \text{ bytes}$$

QUESTION ANALYTICS

Q. 11

Consider Noisy station that detects transmissions and disrupts them by beginning a competing transmission as soon as it hears the beginning of the transmitted frame, thereby causing a collision. Assume Detector machine, which is on this Ethernet with bandwidth 10 Mbps, detects collision during the transmission of its 12^{th} bit on the wire (including any preamble). If the speed of the signal in the wire is 2×10^8 meter/second, then the distance (in meters) of the Noisy station from
Detector machine is _____.

Solution Video | Have any Doubt ?

120 — Correct Option

Solution :
120
If we see the collision after 12 bit times, then that means that the Noisy host sent its competing transmission after 6 bit times. (i.e. one bit from original data and second bit from noisy station, it will be continue till 12^{th} bit)
This means that the distance is

$$= \frac{6 \text{ Bits}}{10 \text{ Mbps}} \times (2 \times 10^8 \text{ m/s})$$

$$= 120 \text{ meters}$$

QUESTION ANALYTICS

Q. 12

Consider an instance of TCP's Additive Increase Multiplicative Decrease (AIMD) algorithm where the window size at the start of the slow start phase is 2 MSS and the threshold at the start of the first transmission is 12 MSS. Assume that a time out occurs during the 7^{th} transmission. The congestion window size at the end of the 12^{th} transmission is _____. (in MSS)

Solution Video | Have any Doubt ?

10 — Correct Option

Solution :
10

Threshold = 12 MSS
Window size for 1st transmission = 2 MSS
Window size for 2nd transmission = 4 MSS
Window size for 3rd transmission = 8 MSS
Window size for 4th transmission = 12 MSS
Threshold reached, increase linearly (according to AIMD)
Window size for 4th transmission = 13 MSS
Window size for 5th transmission = 14 MSS
Window size for 6th transmission = 15 MSS
Window size for 7th transmission = 16 MSS
Time out occurs, resend 8th transmission with window size starting from 2 MSS and new threshold is 8 MSS.
Window size for 8th transmission = 2 MSS
Window size for 9th transmission = 4 MSS
Window size for 10th transmission = 8 MSS
Threshold reached, now increase linearly (according to AIMD)
Window size for 11th transmission = 9 MSS
Window size for 12th transmission = 10 MSS

QUESTION ANALYTICS

Q. 13

A leaky bucket with the capacity of bucket of 200 MB is at the host network interface. The data rate on the network is 2 Mbyte/s. If the host has 450 Mbytes to send onto the network and it sends the data in a burst then the maximum data speed from the host in order that no data is lost is _____ in Mbps.
(Upto 1 decimal place)

Solution Video | Have any Doubt ?

3.6 (3.5 - 3.7) — Correct Option

Solution :
3.6 (3.5 - 3.7)

$$\text{Bucket size} = 450 \text{ Mbyte} - \text{Actual data to send}$$
$$200 \text{ Mbyte} = 450 \text{ Mbyte} - 250 \text{ Mbyte}$$
$$2 \text{ Mbyte} \rightarrow 1 \text{ sec}$$
$$250 \text{ Mbyte} \rightarrow ??$$

$$\text{Time for computer to transmit all data} = \frac{250}{2} = 125 \text{ sec}$$

$$450 \text{ Mbytes} \rightarrow 125 \text{ sec}$$
$$?? \rightarrow 1 \text{ sec}$$
$$\text{Host Max data rate} = (450 \text{ Mbytes})/125 \text{ sec}$$
$$= 3.6 \text{ Mbyte/sec}$$

QUESTION ANALYTICS

Q. 14

The distance between two microwave towers, with the link capacity 100 Mbps, is 24 Km and the speed of the signal is 3×10^8 m/sec. If the frame size is 50 KB in the GoBack-N protocol, The approximate link utilization is _____ in %. (Assume that the ACK packets are negligible in the size and there are no errors during communication) (Upto 2 decimal places)

Solution Video | Have any Doubt ?

75.75 (75.74 - 75.76) — Correct Option

Solution :
75.75 (75.74 - 75.76)

$$\text{Transmission Time (T.T.)} = \text{Data size/Bandwidth}$$
$$= \frac{(50\times10^3)}{100\times10^6} = 500 \text{ microsec}$$

$$\text{Propagation Time (P.T.)} = \frac{\text{Length}}{\text{Velocity}}$$
$$= \frac{(24\times10^3)}{3\times10^8} = 80 \text{ microsec}$$

$$\% \text{ Link utilisation} = \left[\frac{\text{T.T.}}{(\text{T.T} + 2\text{P.T.})}\right]\times100$$
$$= \left[\frac{500}{(500 + 2\times80)}\right]\times100 = 75.75\%$$

QUESTION ANALYTICS

Q. 15

In a RSA cryptosystem, a participant uses two prime numbers p and q is 17 and 11 respectively to generate his/her public key and private keys. If the public key of participant is 7 and cipher text(C) is 11, then the original message(M) is _____.

Solution Video | Have any Doubt ?

88 — Correct Option

Solution :
88

$$p = 17 \text{ and } q = 11$$
$$n = p \times q = 187$$
$$\phi(n) = (p - 1) \times (q - 1)$$
$$= 16 \times 10 = 160$$
$$e = 7$$
$$d = e^{-1} \bmod \phi(n)$$

$= 7^{-1} \bmod 160 = 23$

$M = C^d \bmod n$

$= 11^{23} \bmod 187 = 88$

QUESTION ANALYTICS

Q. 16

Suppose a switch is built using a computer workstation and that it can forward packets at a rate of 500000 packets per second, regardless of size. Assume the workstation uses Direct Memory Access (DMA) to move data in and out of its main memory, which has a bandwidth of 2 Gbps and that the I/O bus has a bandwidth of 1 Gbps. The packet size at which the bus bandwidth become the limiting factor _____ in Bytes.

Solution Video | Have any Doubt ?

125 — Correct Option

Solution :
125

The workstation can handle i.e. limited by the I/O bus = $\frac{1000}{2}$ = 500 Mbps

Let the packet size be x bits;
To support 500000 packets/second we need a total capacity of 500000 × x bps;
Equating $5 \times 10^5 \times x = 500 \times 10^6$ bps,
We get $x = 1000$ bits
$= 125$ bytes

QUESTION ANALYTICS

Q. 17

Consider 3 employees Ramesh, Suresh and Mahesh using three different computers working under Account-Network serviced by a single mail server. Assume Ramesh wish to send e-mail to Sonali, Suresh to Pooja and Mahesh to Vidhi, where Sonali, Pooja and Vidhi working under HRNetwork. What is the worst case and best case number of TCP connections that should be opened to enable this e-mail exchange if all the persons use a non-HTTP e-mail service?

Solution Video | Have any Doubt ?

A. Worst case = 9, Best case = 5

B. Worst case = 9, Best case = 7 — Correct Option

Solution :
(b)
Worst Case: When they sent e-mails at different times.
1 each from Ramesh, Suresh, Mahesh to their **mail server**, one each from **Accounts-mail server** to **HR-mail server** for the 3 e-mails, 1 each from Sonali, Pooja ,Vidhi to the **HR-mail server**) = 3 + 3 + 3 = 9 TCP connections.
Best Case: When all 3 persons send e-mail roughly the same time.
(1 each from Ramesh, Suresh, Mahesh to their **mail server**, one from **Accounts-mail server** to **HR-mail server**, each from Sonali, Pooja ,Vidhi to the **HR-mail server**) = 3 + 1 + 3 = 7 TCP connections.

C. Worst case = 7, Best case = 5

D. Worst case = 9, Best case = 3

QUESTION ANALYTICS

Q. 18

Consider Dijkstra's algorithm in the link-state routing protocol at node u, Professor Ram first sets the route for each directly connected node v to be the link connecting u to v. Ram then implements the rest of the algorithm correctly, aiming to produce minimum-cost routes, but does not change the routes to the directly connected nodes. In this network, u has at least two directly connected nodes and there is more than one path between any two nodes. Assume that all link costs are non-negative. Which of the following statements is False of u's routing table?

Solution Video | Have any Doubt ?

A. There are topologies and link costs where the majority of the routes to other nodes will be incorrect.

B. There are topologies and link costs where no routing table entry (other than from u to itself) will be correct. — Correct Option

Solution :
(b)
(a) Is true since for example, all the neighbors but one could have very high cost, and all the other links have low cost, so all the routes could in fact be just one link.
(b) Is false since The lowest-cost neighbor's route will be the direct link, of course!
(c) Is true since A trivial example is when all the links have equal cost.

C. There are topologies and link costs where all routing table entry (other than from u to itself) will be correct.

D. Both (a) and (b)

QUESTION ANALYTICS

Q. 19

Consider the Select Repeat sliding window protocol is used at datalink layer to transmit frames between Sender and Receiver machine. The receiver sends "ACK k" when it receives a packet with sequence number k. Denote the window size by W. The sender's packets start with sequence number 1. Which of the following is true of a correct implementation of this protocol over a besteffort network?

Solution Video | Have any Doubt ?

A. Any new previously unsent packet with sequence number greater than W is sent by the sender iff a new previously unseen ACK arrives. — Correct Option

Solution :

(a)
(a) Any new previously unsent packet with sequence number greater than W is sent by the sender iff a new previously unseen ACK arrives.
(b) The sender can send more than one packet between the receipt of one ACK and the next because the sender could time-out and retransmit.
(c) The receiver can never discard any new, out-of-order packet it receives after sending an ACK for it because the sender thinks the receiver has delivered this packet to the Receiver.
(d) False since Packets or ACKs could get reordered in the network.

B The sender will never send more than one packet between the receipt of one ACK and the next.

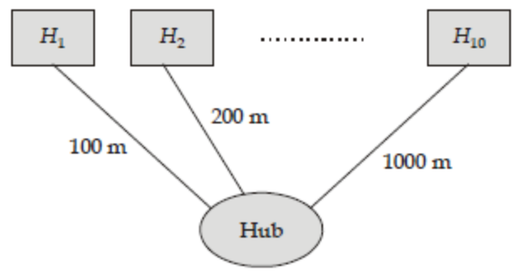
C The receiver can discard any new, out-of-order packet it receives after sending an ACK for it.

D Suppose that no packets or ACKs are lost and no packets are ever retransmitted. Then ACKs will arrive at the sender in non-decreasing order.

QUESTION ANALYTICS +

Q. 20

Consider the speed of propagation of a signal along a cable is 2×10^8 m/s and network has 10 Mbps CSMA/CD network interconnecting ten computers shown in below image. Each computer is connected to the hub with a cable of different length. Computer H1 is connected via a 100 m cable, computer H_2 via a 200 m cable, computer H_3 via a 300 m cable and so on upto computer H_{10}, which is connected via a 1000 m cable (ignore the requirement of repeater due to signal degradation). Assume that the hub introduces a delay of 2.5 microseconds.
What is the shortest packet length Lmin of this network in order to ensure that the CSMA/CD protocol functions properly?



Solution Video | Have any Doubt ?

A 340 bits

B 240 bits — Correct Option

Solution :
(b)

The maximum end-to-end propagation delay is $= \frac{(1000\,\text{m} + 900\,\text{m})}{(2 \times 10^8\,\text{m/s})} = 9.5\ \mu\text{sec}$

The hub introduces an additional 2.5 microseconds delay.
The time taken to transmit $L_{min} \geq 2 \times (9.5\ \mu\text{sec} + 2.5\ \mu\text{sec}) \geq 24\ \mu\text{sec}$
Hence, $L_{min} = 24\ \mu\text{sec} \times 10\ \text{Mbps}$
$= 240$ bits

C 520 bits

D 120 bits

QUESTION ANALYTICS +

Q. 21

Consider the following statements regarding the slow start phase of the TCP congestion control algorithm. Note the cwnd stands for the TCP congestion window and MSS denotes the Maximum Segment Size.
(i) The cwnd increases by 2 MSS on every successful acknowledgment.
(ii) The cwnd approximately doubles on every successful acknowledgment.
(iii) The cwnd increases by 1 MSS every round trip time.
(iv) The cwnd approximately doubles every round trip time.
Which one of the following is correct?

Solution Video | Have any Doubt ?

A Only (ii) and (iii) are true

B Only (i) and (iii) are true

C Only (iv) is true — Correct Option

Solution :
(c)
cwnd approximately doubles every round trip time.

D Only (i) and (iv) are true

QUESTION ANALYTICS +

Q. 22

Consider the following statements regarding TCP's congestion control phases.
(i) The size of the congestion window increases exponentially until it reaches a threshold (in slow start algorithm).
(ii) In multiplicative decrease procedure, threshold gets decreased to one-half of the previous window size.
(iii) The size of the congestion window increases exponentially after achieving threshold value till the timeouts.
Which of the following statements is true ?

Solution Video | Have any Doubt ?

A (i) and (ii) only — Correct Option

Solution :
(a)
In the slow start algorithm, the size of the congestion window increases exponentially until it reaches a threshold, after this there is additive increases (one-one window) till the time outs. Statement (iii) is false.

B (i) and (iii) only

C (ii) and (iii) only

D (i), (ii) and (iii)

QUESTION ANALYTICS

Q. 23

ICMP has error reporting messages. Which of the following error reporting message describes the given statement 'S'?
S : The packet is discarded due to the processing problem observing a change in the header format of the IP datagram.

Solution Video | Have any Doubt ?

A Destination unreachable

B Source quench

C Parameter problem — Correct Option

Solution :
(c)
- In redirection packet is not discarded but it is redirected to a n/w as the host doesn't belong to this network.
- In source quench packet is discarded due to congestion in the n/w.
- Destination unreachable means host is not present in the n/w or the host is not responding to the request, then the packet is discarded.

D Redirection

QUESTION ANALYTICS

Q. 24

Suppose that x bits of user data are to be transmitted over K-hop path in a packet-switched network as a series of packets each containing p data bits and h header bits with $x >> (p + h)$. The bit rate of lines is b bps and Propagation delay is negligible. What is the time taken by the source to transmit total bits?

Solution Video | Have any Doubt ?

A $(p + h)\ x/b$ secs

B $(p + h)\ x/pb$ secs — Correct Option

Solution :
(b)
The total number of packets needed is x/p.
Total data + header traffic is $(p + h)\ x/p$ bits.
The source requires $(p + h)\ x/pb$ seconds to transmit these bits.

C $p\ x/b$ secs

D hx/pb secs

QUESTION ANALYTICS

Q. 25

PURE ALOHA and SLOTTED ALOHA are two multiple access protocols used to decrease collisions. The maximum efficiency obtained from PURE ALOHA and SLOTTED ALOHA can be written as $a \times e^{b}$ and $c \times e^{d}$. What will be the value of 8 $abcd$?

Solution Video | Have any Doubt ?

A 2

B 3

C 4 — Correct Option

Solution :
(c)

Maximum possible efficiency of PURE ALOHA = $\frac{1}{2} \times e^{-1}$

Maximum possible efficiency of SLOTTED ALOHA = $1 \times e^{-1}$

Therefore, $a = \frac{1}{2}, b = -1, c = 1, d = -1$

$$8 \times a \times b \times c \times d = 8 \times \frac{1}{2} \times (-1) \times 1 \times (-1)$$
$$= 4$$

D 5

QUESTION ANALYTICS

Q. 26

Consider the following:

Protocols		Facilities provided
A.	TCP	(i) Flow control
B.	UDP	(ii) Error control
C.	Simple stop and wait	(iii) Congestion control

D. Stop and wait Automatic Repeat Request

Which of the following is a correct matching?

Codes:

(a) A-i, ii, iii, B-ii, iii, C-ii (b) A-i, ii, B-ii, D-ii, iii

(c) A-i, iii, B-i, ii, iii, C-i, ii, iii (d) A-i, ii, iii, B-ii, C-i, D-i, ii

Solution Video | Have any Doubt ?

A a

B b

C c

D d — Correct Option

Solution :
(d)

QUESTION ANALYTICS +

Q. 27

Consider the following statements:
S_1 : Size of OPTIONS field in IPv4 header can be upto 40 bytes.
S_2 : "Version" field in IPv4 and IPv6 header contains the bit sequence 0100 and 0110 respectively.
Which of the option is correct?

Solution Video | Have any Doubt ?

A Only S_1 is true

B Only S_2 is true

C Both S_1 and S_2 are true — Correct Option

Solution :
(c)

S_1 : Size of OPTIONS field in IPv4 header can be upto 40 bytes and hence size of IPv4 header can be in between 20 bytes to 60 bytes.

S_2 : "Version" field in IPv4 and IPv6 header contains '0100' and '0110' respectively.

D Both S_1 and S_2 are false

QUESTION ANALYTICS +

Q. 28

Consider sending a large file of F bits from Host A to Host B. There are two links (and one router) between A and B and the links are uncongested (that is, no queuing delays). Host A segments the file into segments of S bits each and adds 40 bits of header to each segment, forming packets of L = 40 + S bits. Each link has a transmission rate of R bps. What is the value of S that minimizes the delay of moving the file from Host A to Host B? (ignore the propagation delay)

Solution Video | Have any Doubt ?

A $(15F)^{-1/2}$

B $(25F)^{-1/2}$

C $(30F)^{-1/2}$

D $(40F)^{-1/2}$ — Correct Option

Solution :
(d)

Number of packet required to send file of size F = $\frac{\text{File size}}{\text{Size of segment}} = \frac{F}{S}$

Time at which the 1st packet is received at the destination = $\frac{S+40}{R}$ × 2 sec. After this, one packet is received by the destination every $\frac{S+40}{R}$ sec because packets are transmitted back to back by Host A.

Thus delay in sending the whole file is,

$$\text{delay} = \frac{S+40}{R}\times 2+\left(\frac{F}{S}-1\right)\times\left(\frac{S+40}{R}\right)=\frac{S+40}{R}\times\left(\frac{F}{S}+1\right)$$

To calculate the value of S which leads to the minimum delay, we take the derivative and equate it to zero,

$$\frac{\partial \text{delay}}{\partial S} = 0 \Rightarrow \frac{F}{R}\left(\frac{1}{S}-\frac{40+S}{S^2}\right)+\frac{1}{R}=0$$

$$\Rightarrow \quad S = \sqrt{40F}$$

QUESTION ANALYTICS +

Q. 29

Consider TCP implements an extension that allows window sizes much larger than 64 KB. Suppose that you are using this extended TCP over a 1 Gbps link with a latency of 50 ms to transfer a 10 MB file and the TCP receive window is 1 MB. If TCP sends 1 KB packets and time to send the file is given by the number of required RTTs multiplied by the link latency, then the effective throughput for the transfer is _____ Mbps (assuming no congestion and no lost packets). [Upto 1 decimal place]

Solution Video | Have any Doubt ?

14.3 (14.2 - 14.4) — Correct Option

Solution :
14.3 (14.2 - 14.4)

In slow start, the size of the window doubles every RTT.
At the end of the i^{th} RTT, the window size is 2^i KB.
It will take 10 RTTs before the send window has reached 2^{10} KB = 1 MB
After 10 RTTs, data transferred is = 1024 KB = 1 MB

The window size = 1 MB

It takes 4 more RTTs to transfer the remaining 9 MB.
Therefore, the file is transferred in 14 RTTs.

Transfer time = 50 ms

So for sending a full file it take = 14 × 0.05 = 0.7 seconds to send the file

The effective throughput is $\left(\frac{10\,\text{MB}}{0.7\,\text{s}}\right)$ = 14.3 Mbps

QUESTION ANALYTICS

Q. 30

Consider a TCP message that contains 1024 bytes of data and 20 bytes of TCP header is passed to IP for delivery across two networks interconnected by a router (i.e., it travels from the source host to a router to the destination host). The first network has an MTU of 1024 bytes and the second has an MTU of 576 bytes. If all packets are correctly delivered, the number of bytes, including headers, are delivered to the IP layer at the destination for TCP message, in the best
case is _____ bytes. (Assume all IP headers are 20 bytes)

Solution Video | Have any Doubt ?

1104 — Correct Option

Solution :
1104

First network: An MTU of 1024 means that is the largest IP datagram that can be carried, so a datagram has room for 1024 – 20 = 1004 bytes of IP-level data, because 1004 is not a multiple of 8,

each fragment can contain at most $8\times\left\lfloor\frac{1004}{8}\right\rfloor$ = 1000 bytes.

We need to transfer 1024 + 20 = 1044 bytes of data (TCP header is included).
This would be fragmented into fragments of size 1000 bytes, and 44 bytes.
Second network: The 44 byte packet would be unfragmented but the 1000-data-byte packet would be fragmented as follows. The 576 byte MTU allows for up to 576 – 20 = 556 bytes of payload.
So rounding down to a multiple of 8 again allows = 552 bytes in the first fragment.
And remaining 448 bytes in the second fragment.

So total bytes = 552 + 20 + 448 + 20 + 44 + 20
= 1104 bytes

QUESTION ANALYTICS

Q. 31

Consider a router is blasting out IP packets whose total length is 1024 bytes. If packets live for 10 seconds, then the maximum line speed the router can operate at without danger of cycling through the IP datagram ID number space is _____ in Mbps. (Upto 1 decimal place)

Solution Video | Have any Doubt ?

53.7 (53.6 - 53.8) — Correct Option

Solution :
53.7 (53.6 - 53.8)

The IP datagram ID number space is 2^{16} = 65535

Packet lifetime = 10 seconds

Therefore, a maximum of 65535 packets may be sent in 10 seconds. If any more packets were to be sent within the 10 seconds, the same id will be wrap around

$$\text{floor}\left(\frac{65535}{10}\right) = 6553 \text{ packets/sec}$$

Max line speed at 1024 bytes/packet is

= 1024 bytes/packet × 6553 packets/sec × 8 bits/byte
= 53682176 bps
= 53.7 Mbps

QUESTION ANALYTICS

Q. 32

Consider two Hosts A and B are each connected to a router R via 10 Mbps links. The propagation delay on each link is 20 microseconds. R is a store and forward device i.e transmission of the packet on the R-B link begin only if whole packet is received on the A-R link. Suppose R forwards a packet 35 microseconds (processing delay) after it has finished receiving it. The time saved when transmit 10000 bits from A to B as two 5000 bit packets sent one right after the other instead of as a single packet is _____ in µs.

Solution Video | Have any Doubt ?

500 — Correct Option

Solution :
500

Transmit delay of one link = 10^4 bits/10^7 (bits/sec) = 1000 µs
Transmission time for sending as single packet = 2 × 1000 + 2 × 20 + 35 = 2075 µs
When sending as 2 packets,
We have a total of one switch delay and two link delays;

Transmit delay = 5000 bits/10^7 (bits/sec) =500 µs

Transmission time for sending as multiple packets = 3 × 500 + 2 × 20 + 1 × 35 = 1575 µs

Time saved = (2075 – 1575)µs = 500 µs

QUESTION ANALYTICS

Q. 33

Consider a source using TCP-Reno (fast-retransmit and fast-recovery mechanisms) to send data to a destination. It is given the RTT of the link is 800 ms and the sender's window size is 8 segments. The sender sends segments at a regular rate of one every 100 ms, and the receiver sends ACKs back at the same rate without delay. A segment is lost, and the receiver sends 3 duplicate ACKs to trigger the fast-retransmit. If the sender waits for ACK of the retransmitted segment before advancing the window then the total time the sender lost (as compared to lossless transmission) is _____.

Solution Video | Have any Doubt ?

1100 — Correct Option

Solution :

1100

Suppose packet number P is sent at $t = 0$ by the sender's clock.

Suppose P is lost. So, **7 packets : P + 1 to P + 7** will be sent at $t = 100, 200, ..., 700$ respectively, since the window size is 8.

Sender stops sending at $t = 800$, since window size is 8 and ACK for P has not arrived.

ACK for **P + 1, P + 2 and P + 3** will be duplicate ACKs of P – 1(since 3 duplicate CK is used) and will arrive at $t = 900, 1000$ and 1100.

P is retransmitted at $t = 1100$ and ACK arrives at 1100 + 800 = 1900 ms

If no lost of segment then time = 800 ms

Time lost = 1900 – 800 = 1100

QUESTION ANALYTICS +