AUTUMN MID SEMESTER EXAMINATION-2024

Scheme of Evaluation with Model Answers

School of Computer Engineering
Kalinga Institute of Industrial Technology, Deemed to be University
Subject Name: Computer Networks
[CS 30003]

Time: 1 1/2 Hours **Full Mark: 20**

Answer Any four questions including question No.1 which is compulsory.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. Answer all the questions. [1 Mark X 5]

Answering correctly 1 mark. Partial answer 0.5 marks

a) What is the main difference between a Fully Qualified Domain Name (FQDN) and a Partially Qualified Domain Name (PQDN)? CNAME record are used for which purpose.

A fully qualified domain name (FQDN) is the complete domain name for a specific computer/ host, on the Internet. It consists of two parts: the hostname and the domain name. If a label is not terminated by a null string, it is called a partially qualified domain name (PQDN). A PQDN starts from a node, but it does not reach the root. It is used when the name to be resolved belongs to the same site as the client.
Canonical Name or CNAME is a DNS record that maps an alias name to a true or canonical domain name.

b) The following is the contents of a UDP header in hexadecimal format.
0045 DF00 0058 0000
Calculate the destination port number and source port number? What is the length of the data? Has the sender calculated a checksum for this packet.

The destination port number is the second four digits $(DF00)_{16}$ = 57,088.
The source port number is the first four digits or $(0045)_{16}$ = 69.
The total length of the datagram is the third four bits $(0058)_{16}$ = 88 bytes.
The length of the data is 88 -8 = 80 bytes.
The sender has not calculated the checksum for this packet because the value of the checksum is all zeros.

c) In Stop and wait protocol every 4th packet is lost and we need to send total 15(fifteen) packets so how many transmission it took to send all the packets?

After 4 sends, we have a loss. So, packet 4 lost, resent. Packet 7 lost (since 4 was resent), resent. Packet 10 lost, recent and Packet 13 lost, recent. So, total transmission took place is 19.

d) Assume there is a server with the domain name www.kiit.ac.in.

Write the HTTP request that needs to retrieve the document **/usr/users/doc**. The client accepts MIME version 1, GIF or JPEG images.

A possible request

```
GET /usr/users/doc HTTP /1.1
Date: Fri, 20-Sept-24 16:46:23 GMT
MIME-version: 1.0
Accept: image/gif
Accept: image/jpeg
Last modified: Fri, 23-Aug-24
```

e) In TCP, how many sequence numbers are consumed by each of the following segments?
(i) SYN, (ii) ACK, (iii) SYN+ACK, (iv) Data

A **SYN** segment consumes one sequence number.

An **ACK** segment does not consume any sequence numbers.

A **SYN + ACK** segment consumes one sequence number because it is a SYN segment.

For **DATA** segment, the number of sequence numbers consumed depends on the amount of data being sent. A **DATA** segment consumes **n** sequence numbers, where **n** is the number of bytes carried by the segment.

2.(a) A client's browser sends an HTTP request to a website. The website responds with a handshake and sets up a TCP connection. The connection setup takes 8.4 mili seconds(ms), including the RTT. The browser then sends the request for the website's index file. The index file references 22(twenty two) additional images, which are to be requested/downloaded by the client's browser.

Assuming all other conditions are equal, how much longer would non-persistence HTTP take than persistence HTTP. [2.5 Marks]

Answering correctly 2.5 Marks. Partial answer can be awared based on the label of understanding.

Given that the connection setup takes 2.6 ms (including the RTT), we can calculate the time difference as follows:

For non-persistent HTTP, a new connection is needed for each file. Therefore, the total time taken would be:

Number of files * Time per connection

This includes the index file and the 22 images, so:

(1 index file + 22 images) * 8.4 ms = 23 * 8.4 ms = 193.2 ms

For persistent HTTP, only one connection is needed for all files. Therefore, the total time taken would be:

1 * Time per connection = 1 * 8.4 ms = 8.4 ms

Time Difference

The time difference between non-persistent and persistent HTTP would be:
Time for non-persistent - Time for persistent = 193.2 ms - 8.4 ms = 184.8 ms

So, non-persistent HTTP would take 184.8 ms longer than persistent HTTP under these conditions.

2.(b) Describe the following terms related to Eletronic mail applications. [2.5 Marks]

(i) Eletronics mail architecture.

(ii) Mail Transfer Phases,

(iii) Message access agent,

(iv) Multipurpose Internet mail extension

Answering correctly Full marks. Partial answer can be awared based on the label of understanding.

Refer. Section 10.3.3 of textbook for description.

3.(a) State how to compute different types of delays in packet data network. Which of these delays are constant and which are variable?

Answering different types of delays: 1 Mark.

Delays:

- **Transmission delay** - The time taken to transmit a packet from the host to the transmission medium.
- **Propagation delay** - After the packet is transmitted to the transmission medium, it has to go through the medium to reach the destination.
- **Queuing delay** - time the packet spends in routing queues.
- **Processing delay** - Time taken to process the data packet by the processor.

Queueing delay is variable other are constant for each pactet.

Calculate the total time required to transfer a 1.5MB file based on following information.
The bandwidth is 10Mbps, but after we finish sending each data packet we must wait one RTT before sending the next.
Assuming a RTT of 80 ms, a packet size of 1 KB data, and an initial 2×RTT of "handshaking" before data is sent. [2. 5 Marks]

Solving the numericals correctly 1.5 Marks. Wrong answer **Zero** mark.

We will count the transfer as completed when the last data bit arrives at its destination

File size of 1.5 MB=12582912bits.

Initial RTTs (160 ms) + 12,582,912/10,000,000 bps (transmit) + RTT/2 (propagation) **≈1.458seconds**.

Number of packets required =1.5MB/1KB=1536.

To the above we add the time for 1535 RTTs (the number of RTTs between when packet 1 arrives and packet 1536 arrives), for a total of 1.458+122.8 = **124.258 seconds.**

3(b) Draw the TCP header format with the help of a diagram. Explain briefly each fileld. [2.5 Marks]

Answering correctly Full marks. Partial answer can be awared based on the label of understanding. Refer **Section 9.4.3** of Textbook for description.

4.(a) Derive the realationship between window size and sequence number in Go Back N(GBN) and Seletive Repeat (SR) flow control protocol.

Deriveing the realationship between window size and sequence number in Go Back N(GBN) and Seletive Repeat (SR) flow control protocol: 1 Mark.

By considering sequence number as three bit. Calculate the window size for both GBN and SR. With a neat diagram show how it will affect if the window is made larger than the calculated value for both GBN and SR. [2. 5 Marks].

By considering sequence number three bit the maximum window size would be 7 segment for GBN and 4 segment for SR. Proper explanation with diagram 1.5 Marks. Partial answer can be awared based on the presentation.

4.(b) Sender A needs to send a message consisting of nine packets to Receiver B using a siding window (window size 3) and Go-Back-N (GBN) strategy. All packets are ready and immediately available for transmission. If every 5th packet that A transmits gets lost(but no acks from B ever get lost), then what is the number of packets that A will transmit for sending the message to B? [2.5 Marks]

Solving correctly 2.5 Marks. Wrong answer **Zero** mark.

Since all packets are ready initially itself, we can assume a timeout is detected after all possible packets are sent. So, the sending happens as shown as explain below. For 9 packets answer will be 16.

Let's say we have 9 frames to send

1 2 3 4 5 6 7 8 9

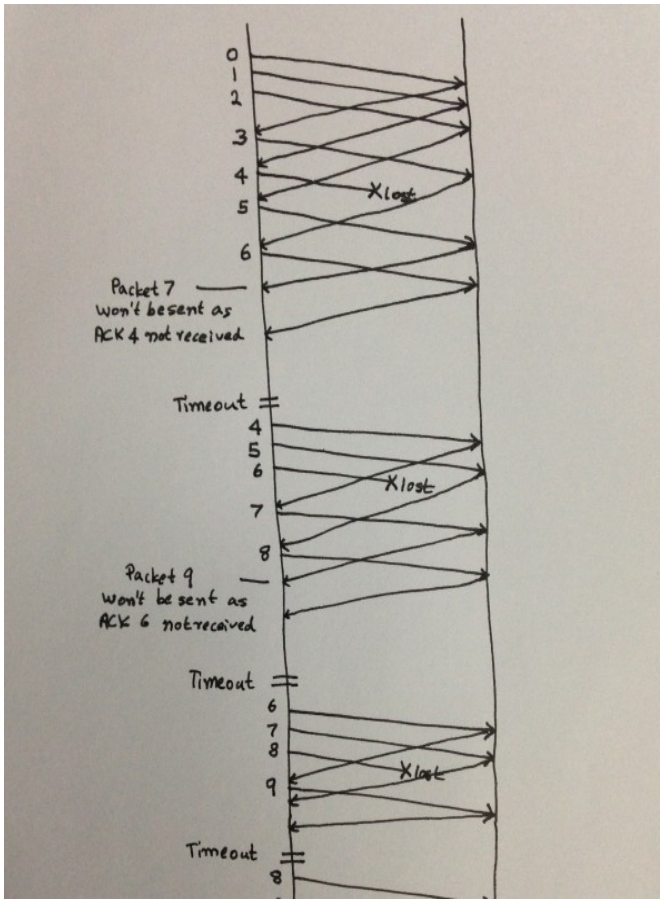
We will send 1 then window will slide and currently 2 3 4 will be frame in the window then we will send 2 window will slide now currently 3 4 5 will be in window snapshot then we will send 3 and window will slide again and current snapshot will have 4 5 6 in window then next 4 will be sent current snapshot will be 5 6 7.

Now point 2 if 5th one is lost then what frames will be sent again well start from 5th and go to end of window that is 7 as window size is 3 so 5 6 7 will be sent again. Try to work it out by using above 2 points plus don't forget to slide the window ahead as you go on sending frame and receive ack. Remember 5 6 7 were sent before as 5 was not received 6 7 were discarded make sure you count then as well

If you get it right the sequence you will get at the end is

1 2 3 4 5 6 7 5 6 7 8 9 7 8 9 9

Above description explain through diagram. Numbering is starting from 0 to 8.



5.(a) In a TCP connection, the initial sequence number is 2171. The clients open the connection, sends three segments, second of which carries 1000 bytes of data and closes connections. What is the values of the sequence in each of the following segments sent by clients? [2.5 Marks]

(i) SYN segment

(ii) Data Segment

(iii) FIN segment

Answering correctly Full marks. Partial answer can be awared Proportionally.

- The sequence number in the SYN segment is 2171. The SYN segment consumes one sequence number; the next sequence number to be used is 2172.
- The sequence number in the data segment is 2172 (which represents the sequence number of the first byte). The bytes in the packets are numbered 2172 to 3171. Note that the client sends the data with the second packet (no separate ACK segment).
- The sequence number in the FIN segment is 3172. Note that the FIN segment does consume a sequence number, but it needs a sequence number to be acknowledged

5. (b) Briefly mention different TCP states and draw TCP state transition diagram. [2.5 Marks]

Mentioning correctly with proper diagram, label and description Full marks. Partial answer can be awared based on the presentation. Refer **Section 9.4.5** of Textbook for description.