Cairo University
Faculty of Engineering
Computer Engineering Dept.
CMP(N)405

Sheet 1

1) Mention three differences between a service and a protocol.

2) Give two advantages for using layered protocols.

3) Mention the names of bottom 4 layers of the OSI model and mention the main functionality for each layer and give examples for a protocol and a network device used in each layer.

4) Mention the names of the OSI layers which are similar to those of TCP/IP model.

5) Which OSI layer handles each of the following?

a. Delivers raw bits from one peer to the other
b. Provides end-to-end communication
c. Divide the raw bit stream into units of transmission
d. Determine the route from source to destination

6) Provide an example for each of the following:

a. Connection oriented protocol
b. Connectionless protocol

7) Write TRUE or FALSE in front of each of the following statements:

a. An implementation of a connectionless service may contain two primitives only.
b. In the OSI model, a protocol specifies the rules governing information exchange between adjacent layers.
c. IPV6 is a layer 3 protocol.
d. A file system provides a connection oriented service.

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sheet 2- part 1

Framing

1) The following character encoding is used in a data link protocol:
A: 01000111; B: 11100011; FLAG:01111110; ESC: 11100000
Show the bit sequence transmitted (in binary) for the four-character frame:
AB ESC FLAG when each of the following framing methods is used:

a. Character count.

b. Flag bytes with byte stuffing.

c. Starting and ending flag bytes, with bit stuffing.

2) One of your classmates has pointed out that it is wasteful to end each frame with a flag byte and then begin the next one with a second flag byte. One flag byte could do the job as well, and a byte saved is a byte earned. Do you agree?

3) When bit stuffing is used, is it possible for the loss, insertion, or modification of a single bit to cause an irrecoverable error? Give one example.

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Sheet 2- Part 2

Error Detection and Correction

1) Sixteen-bit messages are transmitted using a single-bit Hamming code. a) Show the bit pattern transmitted for the payload 1101001100110101. b) How many check bits are needed to ensure that the receiver can detect and correct single bit errors?. Assuming that even parity is used in the Hamming code. c)After transmission, the bit number 20 -starting with index 1- of the packet is modified, show the error correction steps.

2) Consider a datalink protocol that uses character count technique for framing. The data link protocol employs hamming error correction algorithm. Each frame consists of a one byte header consisting of the field "character count".
Assume that there can be no more than one bit error in any single frame.
Ahmed claims that because we have at most one bit error per frame and we use hamming error correction algorithm, then it is possible to resync after any error because if the error occurs in the header, the receiver can correct that error and hence can recover the original value of the "character count" field. Prove or disprove this claim.

3) Show the steps of computing the internet checksum for the stream of data: (0001f203f4f5f6f7)hex. Show how the receiver can check the correctness of the received stream. Arrange data in 16-bit words.

4) What is the remainder obtained by dividing $x^7 + x^5 + 1$ by the generator polynomial $x^3 + 1$?

5) A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is $x^3 + 1$. Show the actual bit string transmitted. Suppose the third bit from the left is inverted during transmission. Show that this error is detected at the receiver's end.

6) Data link protocols almost always put the CRC in a trailer rather than in a header. Why?

Sheet3

Unrestricted Simplex Protocol

1. In the "Unrestricted Simplex Protocol" why we don't need to initialize the frame header ?
2. In the "Unrestricted Simplex Protocol" why we don't need to set a timer at the sender or at the receiver?

Simplex Stop and Wait Protocol

3. In the "Simplex Stop and Wait Protocol" why we don't need to set a sequence number to the sent frames?
4. In the "Simplex Stop and Wait Protocol" why we send a dummy empty ack i.e why we don't set an ack number ?
5. In the "Simplex Stop and Wait Protocol" why we don't need to set a timer at the sender?
6. In the "Simplex Stop and Wait Protocol" why we don't need to set a timer at the receiver?

Simplex Protocol for a noisy channel

7. In the "Simplex Protocol for a noisy channel" why we need to set a sequence number to the sent frames? / why we use one bit only for the sequence number?
8. In the "Simplex Protocol for a noisy channel" why we need to set an ack number to the sent acks?
9. In the "Simplex Protocol for a noisy channel" why we need to set a timer at the sender?
10. In the "Simplex Protocol for a noisy channel" why we may need to set a timer at the receiver?

Link Capacity

11. Assuming a digital data transmission system between Cairo and Alexandria (round trip delay about 250 µs) using a T1-line (1500 kBps), and a frame size of 512 Bytes. The overhead can be neglected. What is the total throughput and efficiency using a stop and wait ARQ protocol?

Design problems

12. In the "Simplex Protocol for a noisy channel" What will happen if the timeout at the sender is smaller than the round-trip delay (even temporarily when sending one packet only)?
13. In the "Simplex Protocol for a noisy channel" Why does the sender re send the last packet it sent when it gets duplicate ACK (I.e. what assumption is made)?
14. In the "Unrestricted Simplex Protocol" assume that the only error that can occur is packet duplication on the reverse channel. That is, a single packet sent by the receiver may be duplicated and arrive as two consecutive identical packets at the sender . what are the minimum changes needed for the protocol to be fully functionable?