

## COE768 Mid-Term Solution

2015

### Question 1:

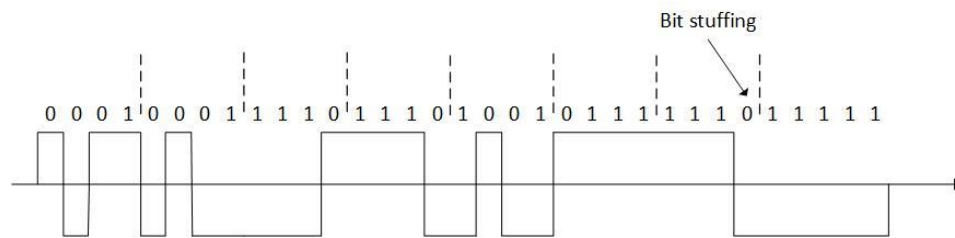
- a) The fact that the transport layer PDU carries the ack. number implies that the error control protocol deployed in the transport layer can recover from transmission error by using the acknowledgement mechanism. In addition, the use of seq. number allows the receiver recognize and reject duplicates. Consequently, the transport layer provides connection-oriented service. On the other hand, the data-link layer PDU does not carry seq. number nor ack. number, so the data-link service must be unacknowledged connectionless.

- b) The one's complement sum of 1110 1001 1111 1111 is 1000, therefore the transport layer PDU is: 1110 1001 0111 1111 1111.

The header of the network layer is 0001 1110 and the header of the data-link layer is 0001. So together, the frame content is:

0001 0001 1110 1110 1001 0111 1111 1111.

- c) With bit stuffing: 0001 0001 1110 1110 1001 0111 11101 1111



### Question 2

- a) Frame header: 00000001 10001011
- b) First frame header: 00000001 00110010  
Second frame header: 00000001 01001010
- c) Frame header: 00000001 10011011
- d) Station B retransmits all the frames in part (b).

### Question 3

$$\text{Since } t_f = \frac{8000}{10^7} = 8 \times 10^{-4}, \text{ therefore, } a = \frac{20 \times 10^{-3}}{8 \times 10^{-4}} = 25.$$

To achieve high efficiency,  $W_s \geq 51$

- a) Since the channel is quite noisy, we expect, on the average, one in every  $(100000/8000 =) 12.5$  frames will be corrupted by noise and required retransmissions. If go-back-n is used, the transmitter must retransmit all the outstanding frames which could be as large as  $W_s$ . Consequently, selective-repeat should be used. For in this case, the transmitter only needs to retransmit the corrupted frames only.
- b) If selective-repeat is used, then the minimum sequence space size  $N = 2 W_s = 102$ . Therefore, the number of sequence bits is 7.
- c) The timeout should be at least as long as the round trip delay, so 10 msec will not be considered. If the timeout is chosen at 20 msec, some of the outstanding frames transmitted after a corrupted frame may be timeout prematurely. This argument can also be applied to the timeout of 30 msec. The timeout of 50 msec is the only one that is large enough to prevent premature timeout. So we should choose the timeout of 50 msec.

#### Question 4

PDU types: N=="New", R=="Ready", D=="User message", E=="Cumulative echo message",  
T=="Session termination"

```
char buf[1000];
struct pdu{
char type;
char data[100];
}tpdu, rpdu;
...
while(1){
    n = recvfrom( ..., &rpdu, ...);
    if(rpdu.type = 'N'){
        tpdu.type = 'R';
        sendto(..., &tpdu, ...);
        total = 0;
        n = recvfrom(..., &rpdu, ...);
        while(rpdu.type != 'T'){
            if(rpdu.type == 'D'){
                memcpy(&buffer[total], rpdu.data, n-1);
                total = total + n;
                memcpy(tpdu.data, buffer, total);
                tpdu.type = 'E';
                sendto(..., &tpdu, ...);
            }
            n = recvfrom(..., &rpdu, ...);
        }
    }
}
```