COE768 Mid-Term Solution

2016

Question 1:

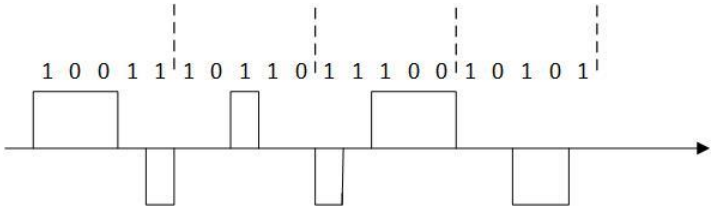
a) The frame without the checksum has the following content:

10011010 00000000 01111110 00000011.

The 1's complement sum is 11100011.

The frame content: 10011010 11100011 01111110 00000011.

b) After the 4B/5B mapping, the bit stream is 10011 10110 11100 10101.



c) The 4B/5B coding Maps a 4-bit word to a 5-bit symbol. The 5-bit symbols contain two or more number of 1's. Since differential coding is used, a transmission of '1' will cause signal transition, thus provides bit synchronization. Since there are 32 5-bit symbols and only 16 of those are used for data, four of the unused symbols are then can be used for frame synchronization.

Question 2

a) Since the number of outstanding frames at t=20msec is 4, station A can send 3 data frames with the following header contents:
   - Type = information, seq= 3, next=6.
   - Type = information, seq= 4, next=6.
   - Type = information, seq= 5, next=6.

b) Station A will send a NAK acknowledgement frame:
Type = NAK, next=6.

c) Station A will send the last of the four data frames:

Type=information, seq=6, next=7.

Question 3

Since $t_f = \frac{8000}{10^8} = 8 \times 10^{-5}$, therefore, $2a = \frac{10^{-3}}{8 \times 10^{-5}} = 12.5$.

a) By using the largest allowable frame size (1000 bytes), we find that 2a= 12.5. This is the minimum value of "2a". If the frame size is smaller than 1000 bytes, the value would be larger. With 2a=12.5, link efficiency for the stop-and-wait protocol is 1/12.5 < 0.95. This means that stop-and-wait protocol cannot be used. In between go-back-n and selective-repeat, since one of the goals is to minimize the implementation complexity and since the bit-error-rate is very low, therefore, go-back-n should be used.

b) If go-back-n is used, the minimum window size, Ws, should be 14. The minimum sequence space size $N = W_s + 1 = 15$. Therefore, the number of sequence bits is 4.

c) The maximum size of the data frame should be 1000 bytes. If we have smaller data frame size, then we need to increase Ws. The consequence is that we need to allocate more bits for the sequence number, thus, increase the overhead.

d) Each station should have transmitting buffer of 14000 bytes to store all the possible outstanding frames. On the other hand, it only need a receiving buffer of 1000 bytes to store the in-sequence frame.

Question 4

1.
```
struct PDU{
  char    type;
  char    data[BUFSIZ];
} rpdu, tpdu;
…
connect(sd, (struct sockaddr *) &server, alen);
while(1){
  printf("Please enter command: T- Send message; O-over. Q-Quit \n");
  scanf("c",&cmd);                    //Read user command
  if(cmd == 'T'){                     // Send data
        n=read(0, &tpdu.data, BUFSIZ);
        tpdu.type = 'D';
        write(sd, &tpdu, n+1);
        printf("Please enter command: T- Send message; O-over; Q-Quit \n");
  }
  if(cmd == 'O'){                     //Over
        tpdu.type = 'O';
        write(sd, &tpdu,1);
  }
  if(cmd == 'Q'){                     //Quit the chat
        tpdu.type = 'Q';
        write(sd, &tpdu, 1);
        close(sd);
        exit(0);
  }
```

```
  while(1){                                    //Receive Data
        n = read(sd, &rpdu, BUFSIZ);
        if(rpdu.type == 'D') write(1,rpdu.data,n-1);
        if(rpdu.type == 'O') break;
        if(rpdu.type == 'Q') {
              close(sd);
              exit(0);
        }
  }
}
```