

- 1a What is the essence of Nyquist's theorem? 5pt
1c What is the usual way to increase the maximum bit rate of a 2400 baud line? 5pt

- 2a Explain why the contention period in a CSMA/CD protocol has to be 2τ , where τ is the maximum propagation time? 5pt
2b How can you prevent, in a wireless network in which station A wants to transmit something to B , that reception of B is distorted by C , because C did not know that A was sending? 10pt

3 CONSIDER THE PROTOCOL DESCRIPTION ON THE NEXT PAGE

- 3a Explain what the *receiver* does, when the packet that is sent in line 12, gets lost. Maak duidelijk wat de *ontvanger* doet, als het pakket dat in regel 12 verzonden wordt, verloren raakt. 5pt
3b Explain what the *sender* does, when the packet that is sent in line 12, gets lost. 10pt
3c Explain what the *sender* does, when the acknowledgment for the packet that is sent in line 12, gets lost. 5pt

Grading: The final grade is calculated by accumulating the scores per question (maximum: 45 points), and adding 5 bonus points. The maximum total is therefore 50 points.

```
01 void protocol4 (void) {
02     seq_nr next_frame_to_send, frame_expected;
03     frame r, s;
04     packet buffer;
05     event_type event;
06
07     next_frame_to_send = 0; frame_expected = 0;
08     from_network_layer(&buffer);
09     s.info = buffer;
10     s.seq = next_frame_to_send;
11     s.ack = 1 - frame_expected;
12     to_physical_layer(&s); start_timer(s.seq);
13
14     while (true) {
15         wait_for_event(&event);
16         if (event == frame_arrival) {
17             from_physical_layer(&r);
18             if (r.seq == frame_expected){
19                 to_network_layer(&r.info);
20                 inc(frame_expected);
21             }
22             if (r.ack == next_frame_to_send){
23                 from_network_layer(&buffer);
24                 inc(next_frame_to_send);
25             }
26         }
27         s.info = buffer;
28         s.seq = next_frame_to_send;
29         s.ack = 1 - frame_expected;
30         to_physical_layer(&s); start_timer(s.seq);
31     }
32 }
```