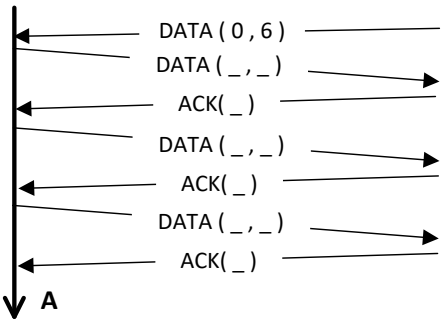
FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA
Departamento de Engenharia Eletrotécnica
Telecommunications Section

Preparation Exercises for the 3rd Test, for the class of June 6, 2018

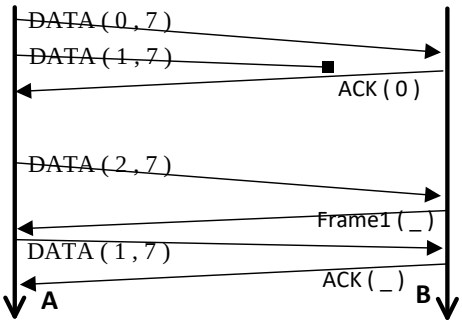
1. Consider the exchange of frames represented on the right, with a *Stop&Wait* sliding window protocol with piggybacking using **3 bit** sequence numbers with. In DATA(*seq* , *ack*), the first parameter indicates the sequence number and the second the acknowledgment number. **No errors occurred in the channel**.



a) What should be the values of *seq* and *ack* fields represented in the figure with "_"? Justify the answer.

b) If you used a Go-Back-N sliding window protocol with a transmission window with 3 frames, what would be the sequence of frames that would occur in the channel to transmit the same data frames (also without errors)? Represent the order in which the frames would be sent and received by node A.

2. Consider the exchange of frames represented on the right, with a sliding window protocol with NAKs (*Negative Acknowledgements*), using 3 bits sequence numbers. In DATA(*seq* , *ack*), the first parameter indicates the sequence number and the second the acknowledgment number. You know that frame *DATA(1,7)* was lost during its first transmission and that no additional errors occurred in the channel.



a) Indicate what frame type Frame1 is and what is the value of its parameter (represented in the figure with "_")? Justify the answer.

b) What is the value of the parameter of the last ACK frame when using the Go-back-N protocol and when using the Selective Repeat protocol? Justify the answer to the two cases requested.

3. In a communication system adopting the "***Selective Repeat***" protocol without "***piggybacking***" each node transmits 1Kb length frames at 1Mbps. The maximum propagation delay of the transmission line is 100ms. What is the minimum length of the transmission window to avoid a node stopping its transmission due to be waiting for ACK (acknowledgement) frames (admit a transmission delay of 0.5ms per frame, independently of the type of frame)?

4. What are the p-persistent Carrier Sense Multiple Access (CSMA) and ALOHA slotted protocols? Which allows you to have higher throughput? Briefly describe their operation and differences and justify your response.

5. Assume that in a local network with 8 stations (station 0 to station 7) the bit-map protocol is used. Each data frame has a duration equal to 1000 reservation slots. Assume that at a given time, after a transmission of a data frame, the stations 2, 3, 6 and 7 have frames to send. i) How many reservation slots are used? ii) What will be the sequence of reservation slots and frames that will occur in the channel until the four stations transmit the four packets?

6. Four stations with addresses A, B, 2 and 3 (in hexadecimal) compete for the medium using the **Binary Countdown** protocol. Describe all steps until the first station has access to the medium to transmit.

7. Assume that in a local network with 8 stations (station 1 to station 8) the **Adaptive Tree-walk** protocol is used. In a sequence of 3 data slots (from the beginning of the tree): in the first transmission slot there is a collision between frames, and the second and third slots have transmissions successfully. How many stations had frames to send at the beginning? Give an example of a set of stations that could give rise to this pattern of transmissions.

8. The switched IEE 802.3 (Ethernet) networks evolved continuously from IEEE 802.3 10Base-T, with the rate of 10 Mbps, to the 10GBase-T network, with the rate of 10Gbps. What remained of the 10Base-T protocol in this evolution: i) The use of the CSMA/CD protocol? ii) The possibility of using hubs? iii) The format of the addresses? iv) The format of the frames?

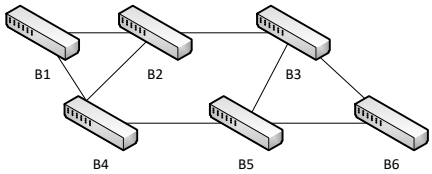
9. What the "hidden node problem" in wireless networks? Of the two medium access control (MAC) protocols you studied, what are the ones that allow you to solve this problem: the IEEE 802.11 DCF, the MACA, both, or none? Justify your answer.

10. In standard IEEE 802.11 the frames RTS (*Request To Send*) /CTS (*Clear To Send*) are not always transmitted. What are these frames for? Why are not they always used?

11. There are two very important time intervals in IEEE 802.11: SIFS (Short InterFrame Spacing) and DIFS (DCF InterFrame Spacing). Explain what SIFS is for and how it works.

12. Discuss the following sentence, indicating whether it is true or false: "Both the CSMA/CD and CSMA/CA use slots and apply the binary exponential backoff (BEB) algorithm." Justify your answer.

13. Consider the network represented in the figure on the right with six interconnected bridges (switches). What network will be considered to run the backward learning algorithm when using the 802.1D protocol? Justify your answer.



14. Consider the network shown on the right. Since the network was connected, the following six frames passed through the B2 bridge:
    Frame from E to A;
    Frame from A to E;
    Frame from D to C;
    Frame from B to F;
    Frame from D to G;
    Frame from B to G.
    What does the B2 bridge routing table contain?