Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin
Ollscoil Átha Cliath | The University of Dublin

Faculty of Engineering, Mathematics & Science

School of Computer Science and Statistics

Integrated Computer Science **Trinity Term 2017**
Year 2 Annual Examinations
BA (Mod) Computer Science and Business
Year 3 Annual Examinations

Telecommunications II

Friday 5th May 2017 **RDS Main Hall** **09.30 – 11.30**

Prof. Stefan Weber

Instructions to Candidates:
Answer 2 questions.
All questions carry equal marks (50 marks).
Answer each question in a separate answer book.

Materials permitted for this examination:
Calculator (non-programmable)

Question 1)

a) One of the tasks of the Link layer in the OSI stack is called "flow control". The High-Level Data Link Control (HDLC) protocol defines a number of types of frames shown in figure 1.

Assume that node A, address 10001111, uses HDLC to send 5 frames to node B, address 11110000. The code in the S-Frame for an acknowledgement is 00 and for a negative acknowledgement is 11. The flag byte consists of the bit-sequence 01111110.

i) Draw the exchange of the frames in much detail as possible for a Stop-and-Wait approach and for a Selective-Repeat approach. Your diagram should be accompanied by an explanation of the process and of assumptions in case you made any.

ii) Explain the process that takes place when the information that is being transferred includes the same bit-sequence as the flag byte.

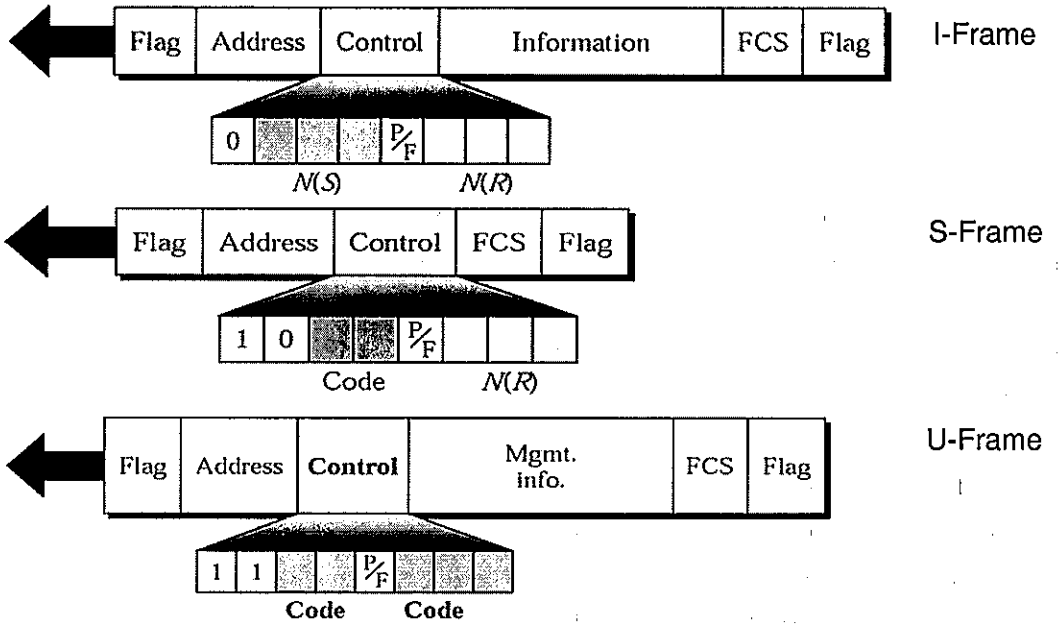


Figure 1: Types of HDLC frames

[30 marks]

b) Assume you have connections with the following characteristics:

i) A connection that exhibits sporadic bursts of errors. Transmissions over this connection are not costly and the transmission delay and round-trip-time are considered to be short.

ii) A connection that exhibits few errors which are generally limited to single bits. Transmissions over this connection are costly and the transmission delay and round-trip-time are considered to be long.

Propose an error detection approach for the connections in i) and an error detection approach for connections in ii) and explain the details of each approach. Justify your choices and contrast them against alternatives in each case that would not be as suitable as your choices. [20 marks]

[Total 50 marks]

Question 2)

a) A number of medium access protocols have been proposed that can be used to determine the access to the medium for a set of stations.

i) Assume that your wired network currently uses a Time-Division Multiple Access (TDMA) approach that is configured to accommodate 6 stations. Explain how stations in this network gain access to the medium and the advantages and disadvantages of this approach. Your explanation should be accompanied by diagrams that visualise the behaviour of the protocol and its limitations.

ii) Assume that your supervisor asks you to propose a protocol that could be used instead of TDMA in i) and that would be suitable to accommodate a varying number of stations. Suggest a suitable protocol, explain the procedure by which stations would gain access to the medium by competing with each other and discuss the advantages and disadvantages of this protocol. Your explanation should be accompanied by diagrams that visualise the behaviour of the protocol and its limitations.

[26 marks]

b) IEEE 802.11 defines two methods for medium access control, the Distributed Coordination Function (DCF) and the Point Coordination Function (PCF).

i) Describe the two methods, DCF and PCF, in your own words, and discuss the importance of interframe spaces.

ii) Explain the coordination of communication between an access point and 5 laptops when using DCF and when using PCF. Your explanation should be accompanied by diagrams that visualise the behaviour of the protocol and its limitations.

[24 marks]

[Total 50 marks]

Question 3)

a) Trinity College currently uses a class B network with address range 134.226.0.0 to 134.226.255.255 for a number of its network nodes. The network has around 20,000 nodes. The traffic of 200 of these nodes is allowed to pass to the Internet without being blocked by routers; the traffic of the remaining nodes is never directly routed into the Internet.

i) Describe the routing of an IP packet from a node inside the network to a server outside the network e.g. a server at Google, and from a server outside to a node inside the network. Your answer should consider both cases, where a node is blocked by routers from communicating outside Trinity's network and where a node is allowed to communicate outside the network. Your description should be accompanied by diagrams that visualise the concepts.

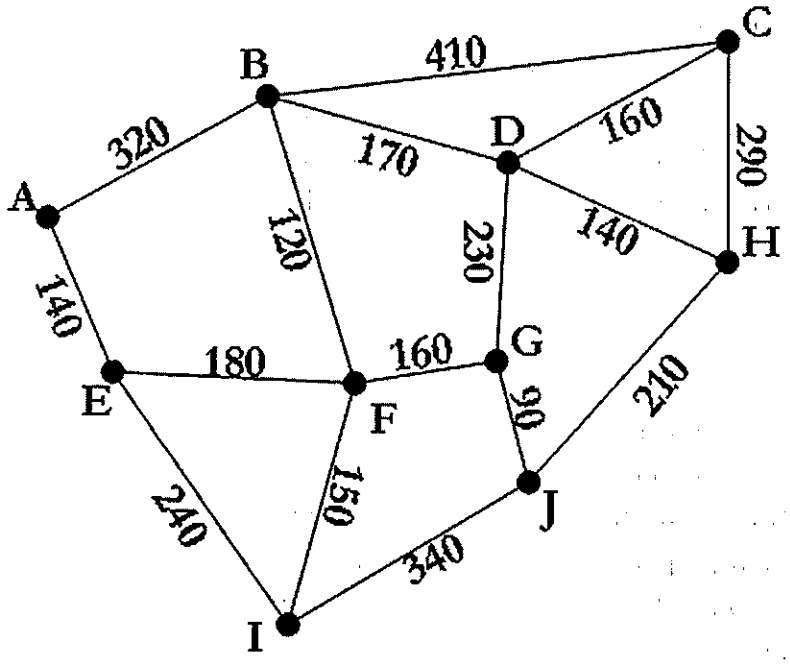
ii) Discuss the application of Network Address Translation (NAT) to the network of Trinity College, the possible allocation of addresses and the effect that this may have on the consumption of publicly routed IP addresses. Your description should be accompanied by diagrams that visualise the concepts.

[20 marks]

b) Link State Routing (LSR) represents one of the major routing concepts.

i) Describe the two components of LSR i.e. the establishing of a view of the topology and the execution of Dijkstra's Shortest Path algorithm in your own words. The description should be accompanied by diagrams where appropriate.

ii) Explain the process of establishing a routing table for node I using the two components with the help of the following diagram. The numbers on the edges indicate the cost or weight for communicating over the connection.



[30 marks]

[Total 50 marks]