UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Faculty of Engineering, Mathematics & Science

School of Computer Science and Statistics

Integrated Computer Science Programme — Trinity Term 2013

Annual Examination

Telecommunications II – CS2031

Friday 3rd May 2013 **Luce Lower** **09:30-11:30**

Stefan Weber

Instructions to Candidates:

Answer 2 questions.

All questions carry equal marks (25 marks).

Answer each question in a separate answer book.

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

Materials omitted from the front page of an examination paper may not be used or consulted during an examination.

SECTION A

Question 1

(1a) Describe the calculation of a Cyclic-Redundancy Checksum (CRC) on an example of your choosing and demonstrate the first 4 steps of the calculation. Show the data bits and CRC bits of the bit sequence that would be transmitted and discuss the interpretation of the possible outcomes of the calculation at the receiver.

(10 marks)

(1b) The terms "Stop-and-Wait ARQ" and "Selective Repeat ARQ" specify well-known Flow Control mechanisms. Explain each of the mechanisms in turn including the state that needs to be kept at the sender and receiver side of a transfer, the reaction of each mechanism to transmission errors in the transfer of the various packets and the advantages and disadvantages of each mechanism. The explanation of each mechanism should be accompanied by diagrams that visualise the transfer of the packets.

(15 marks)

(Total 25 marks)

Question 2

(2a) Assume that four stations are connected by a bus in a single collision domain in an Ethernet network. The access to the medium is controlled by a Carrier Sense Multiple Access (CSMA) scheme with Collision Detection (CD). Assume that at least a number of transmission attempts lead to collisions.

Describe the process that a station follows to transmit a frame. Use diagrams to visualize the chronological exchange of the frames and the reaction to collisions.

(10 marks)

(2b) An access point coordinates the communication between 10 laptops using the Distributed Coordination Function (DCF) of IEEE 802.11. Assume that 3 laptops have data to transfer and want to access the medium simultaneously.

I) Describe the frames that are exchanged by the access point and the laptops and the inter frame spaces that are involved in this exchange. Use diagrams to visualise the chronological exchange of the frames and the inter frame spaces that are involved in the exchange.

II) Discuss the effect that results from an increase of the number of transmitters from 3 laptops to 10 laptops.

(15 marks)

(Total 25 marks)

Question 3

(3a) The Transmission Control Protocol (TCP) applies congestion controls to individual connections between two endpoints.

I) Discuss the motivation for congestion control in TCP and describe the behaviour that is desired from a mechanism for congestion control.

II) Explain the behaviour of the two approaches, Additive-Increase Multiplicative-Decrease (AIMD) and Slow Start and contrast their behaviour on an example of your choosing.

(15 marks)

(3b) Assume that the Transmission Control Protocol (TCP) is used to manage the communication between a client and a server. The client sends a message of 150 bytes in one segment to the server, the server responds to this with a message of 10000 bytes – sent in 9 segments – and the client confirms the receipt of this with a message of 80 bytes in one segment. Every segment is acknowledged with an individual acknowledgement segment.

I) Describe the sequences of segments that are exchanged and

II) determine the overhead that is introduced through TCP's connection management.

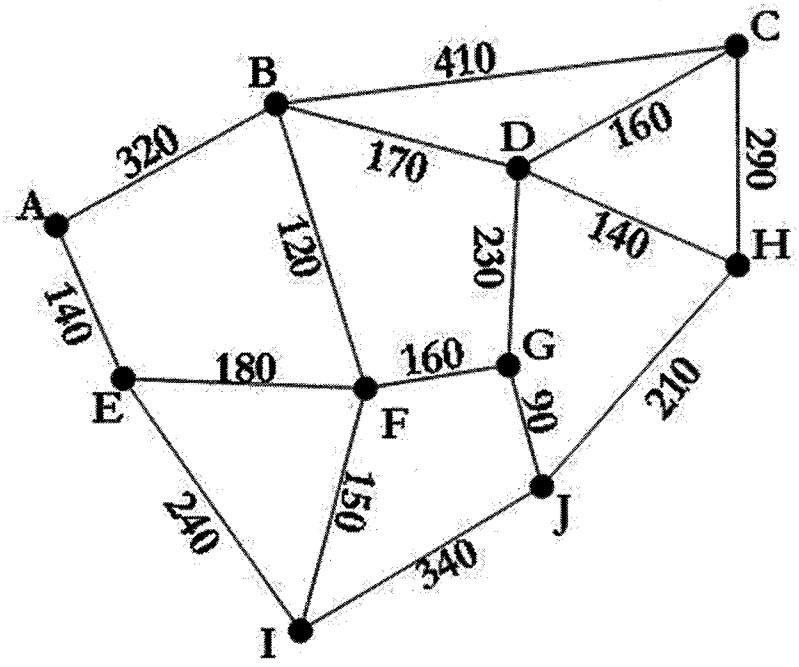
The explanations should be accompanied by diagrams that visualise the chronological exchange of segments.

(10 marks)

(Total 25 marks)

Question 4

(4a) Link State Routing (LSR) represents one of the major routing concepts. Describe the LSR concept in your own words. The description should be accompanied by diagrams where appropriate. Dijkstra's Shortest Path algorithm is used in LSR to determine the routing table of individual nodes. I) Describe this algorithm and II) explain it with the help of the following diagram.



(10 marks)

(4b) A range of IPv4 addresses has been reserved for multicast communication.

I) Describe the general principle of multicast communication in IPv4 and discuss its advantages and disadvantages.

II) The implementation of multicast in IPv4 is currently split into two levels: 1) Communication between an endpoint and a router at the local network and 2) communication between routers that form a local infrastructure. Explain the general functionality of the protocols at both levels.

III) Give an example of a protocol that is implemented to facilitate the communication between routers in a local infrastructure and explain the functionality of this protocol.

(15 marks)

(Total 25 marks)