TRINITY COLLEGE DUBLIN

THE UNIVERSITY OF DUBLIN

Faculty of Engineering, Mathematics & Science

School of Computer Science and Statistics

Integrated Computer Science Programme
BA (Mod) Business and Computing
Year 2 Annual Examinations

Trinity Term 2015

Telecommunications II

Monday 27th April, 2015 Gold Hall 14:00 – 16:00

Dr 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) One of the tasks of the Link layer in the OSI stack is called flow control.

i) Define the term "flow control" and explain the trade-off in the design of flow control mechanisms by discussing a number of flow control mechanisms.

ii) Explain the Selective-Repeat mechanism on an example of your choice. The explanation should be accompanied by a diagram that visualise the transfer of the packets.

iii) Discuss the performance of the Selective-Repeat mechanism in comparison to the performance of the Stop-And-Wait mechanism.

(15 marks)

(1b) Cyclic-Redundancy Checksums (CRCs) may be used as error control mechanisms in the Link layer.

i) Describe the calculation of a CRC on an example of your choosing and demonstrate the first 4 steps of the calculation.

ii) 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)

(Total 25 marks)

Question 2

(2a) Carrier Sense Multiple Access (CSMA) with Collision Detection (CD) is being used as mechanism for medium access control in a wired network.

i) Explain the competition for the medium using CSMA/CD and discuss why collision detection is used instead of collision avoidance in wired networks.

ii) Contrast CSMA/CD with an access method of your choice on an example of 3 nodes wanting to transmit over a wired network. Use diagrams to visualize the chronological exchange of the frames.

(12 marks)

(2b) An access point coordinates the communication between 5 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.

(13 marks)

(Total 25 marks)

Question 3

(3a) The use of classful addressing leads to the risk of depletion of IPv4 addresses.

i) Describe the concepts of Network Address Translation (NAT) and Classless Inter-Domain Routing (CIDR), their effect on the depletion of IPv4 addresses.

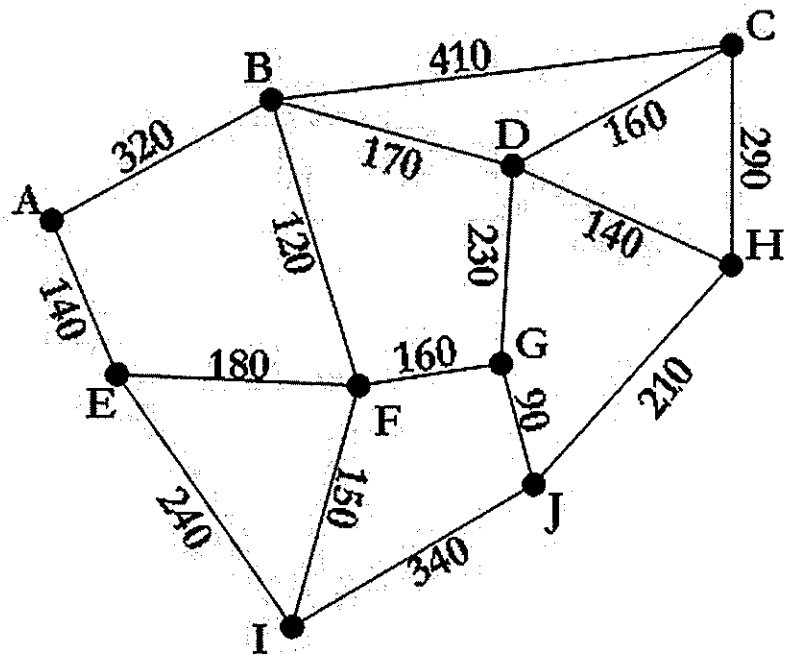
ii) Discuss how these concepts could be applied to the network of Trinity College. The College currently uses a class B network with around 20,000 nodes; the traffic of 200 of these nodes is allowed to pass to the Internet without being blocked by routers. Your description should be accompanied by diagrams that visualise the concepts.

(12 marks)

(3b) 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 the two components of LSR i.e. the establishing of a view of the topology and the execution of Dijkstra's Shortest Path algorithm and

ii) Explain the two components with the help of the following diagram.



(13 marks)

(Total 25 marks)

Question 4

(4a) 4000 bytes are to be transferred between two hosts, A and B. In one case the Transport Control Protocol (TCP) is used for this transfer and in a second case the User Datagram Protocol (UDP) is used.

i) Describe the packets that are involved in the transfer of the data in each case and compare the overhead that is involved in the transfer. The description of the communication should include a description of the reaction to transmission errors.

ii) Discuss the advantage and disadvantage of each protocol using the transfer of the 4000 bytes from a server to a client as an example. Use diagrams to visualise the communication for each case.

(15 marks)

(4b) Congestion control represents an integral component of transport protocols such as the Transport Control Protocol (TCP).

i) Describe the motivation for congestion control and the general approach that is used to determine that congestion is taking place in a network.

ii) Explain a congestion control mechanism of your choice and describe the reaction of the mechanism to congestion.

(10 marks)

(Total 25 marks)

© THE UNIVERSITY OF DUBLIN 2015