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 Programme   **Trinity Term 2016**
Senior Freshman Annual Examinations
BA (Mod) Business and Computing
Junior Sophister Annual Examinations

Telecommunications II

Tuesday 10th May 2016   **RDS**   **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)

Question 1)

a) 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) Assume that you are asked to provide a Selective Repeat mechanism and a Go-Back-N mechanism for communication between two stations A and B. Describe with the help of diagrams the exchange of 10 frames between A and B for both mechanisms, including the handling of transmission errors.

   iii) Discuss the advantages and disadvantages of a Selective Repeat mechanism in comparison to a Stop-and-Wait mechanism.

[15 marks]

b) Cyclic-Redundancy Checksums (CRCs) may be used as error control mechanisms in the Link layer. Suppose we want to transmit the message 1011001001001011 and protect it from errors using the CRC-8 polynomial x^8+x^2+x+1.

   i) Describe the calculation of a CRC 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)

a) Carrier Sense Multiple Access (CSMA) with Collision Detection (CA) and Time Division Multiple Access (TDMA) are used as mechanism for medium access control in wireless networks.

  i) Assume that four stations use a wireless medium to communicate. All stations intend to transmit data at the same time as all other stations. The access to the medium is controlled by a CSMA/CA scheme or a TDMA scheme with a reservation protocol. Discuss both access control schemes for the above scenario.
  Your analysis should be accompanied by diagrams that visualise the behaviour of the two schemes in each of the scenarios.

  ii) Contrast CSMA/CD against 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.

[13 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.

[12 marks]
[Total 25 marks]

Question 3)

a) Internet Protocol version 4 (IPv4) and version 6 (IPv6) addresses represent two of the main forms of addressing in the Network Layer.

  i) Explain the concept of classful addressing, the motivation for the introduction of this concept, and the 5 classes that were suggested for the use with IPv4 addresses.

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

  iii) Discuss the format of IPv6 addresses and the changes that the introduction of IPv6 addresses represents in contrast to IPv4 addresses.

[12 marks]

b) Distance Vector routing represents one class of basic routing approaches.

  i) Explain the exchange of routing information in a Distance Vector routing approach on the sample topology shown in figure 1 and contrast it with the establishment of routing tables in Link State routing approaches. Your description should be accompanied by diagrams that visualise the concepts.

  ii) Discuss the effects of router failures in a Distance Vector routing approach and the mechanisms that have been proposed to address these effects.
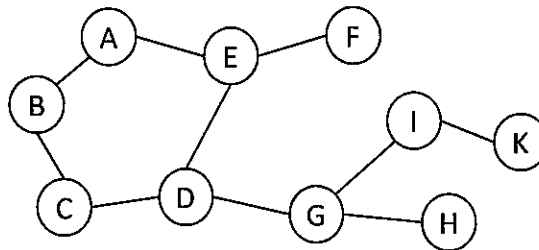

Figure 1: Sample Topology showing routers A to K and their interconnection

[13 marks]
[Total 25 marks]