OLLSCOIL NA hEIREANN, CORCAIGH
THE NATIONAL UNIVERSITY OF IRELAND, CORK

COLAISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

Summer Examination 2008
Second Science

Computer Science
CS2204 – Network Computing

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You may use a calculator.
Attempt all four questions.

Time allowed: 3 hours

Question 1: General Concepts [20 marks]

Each sub-question below is worth 2 marks. Answer either *True* or *False* in each case.

a) The Internet Protocol (IP) is a network –layer protocol.

b) The OSPF routing protocol is based in the Distance-Vector algorithm.

c) Border Gateway Protocol (BGP) is an intra-domain routing protocol.

d) IPv6 addresses are 128-bits in length.

e) UDP provides reliable message delivery.

f) HTTP uses TCP as its underlying transport protocol.

g) In an IP network, Virtual Private Networks (VPNs) are implemented with Tunnels.

h) The ping command is implemented using DHCP.

i) TCP uses the sliding window mechanism to achieve flow control.

j) When using symmetric key cryptography the sender and receiver keys are different.

Question 2: Internetworking [40 marks]

a) Explain the basic principles of datagram packet switching as used in the Internet. *[5 marks]*
Identify the main steps that are taken by an IP router in processing a newly arrived packet. (*Hint:* think about the main fields in the IP header and what they are used for). *[10 marks]*

b) Using an example, explain the motivation for using classless IP addressing instead of class-based IP addressing. *[4 marks]*
For the address 192.1.23.0/24, identify the subnet address. *[3 marks]*
State how many unique *host*s can be identified using this address? *[3 marks]*

c) State briefly the purpose of using DHCP. *[5 marks]*
Explain the difference between static and dynamic allocation of addresses by a DHCP server. *[6 marks]*
When allocating dynamic addresses, what mechanism is used by DHCP to deal with reclaiming addresses from hosts that become disconnected or crash? *[4 marks]*

Question 3: End-to-End Protocols [40 marks]

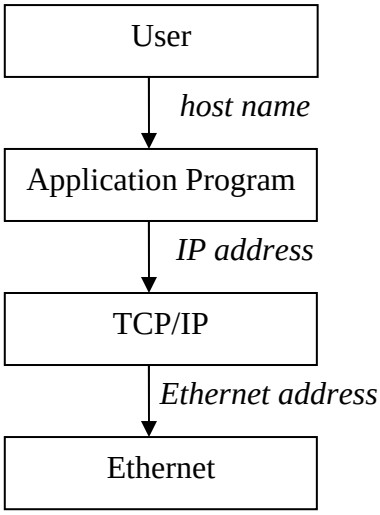
a) Draw a diagram showing the sequence of headers in a packet as it would be sent from a web browser to a web server. *[4 marks]*.
Explain what fields in the packet are used for demultiplexing, starting after it arrives at the destination host and following through to ultimate delivery to the web server program *[6 marks]*.

b) TCP achieves reliability and flow control by using a sliding-window protocol.
   i) What information is conveyed to the sender by the receiver using the Advertised Window field? Briefly explain how this is used to achieve flow control. *[7 marks]*
   ii) Consider two hosts, A and B, with an open TCP session. A sends a segment with sequence number 2600 and after some time receives a segment from B with sequence number 3500 and acknowledgment number 3601. How many bytes were received and confirmed by host B? What is the meaning of 3500? *[8 marks]*

c) Imagine you are asked to design an application-layer protocol to request playback of movies stored on remote video servers. Briefly explain the elements of your protocol, specifically referring to types of messages, key message fields, protocol states, message responses & error codes. (*Hint:* start by thinking about the commands that a user would wish to send to the video server). Discuss whether you would use TCP or UDP as the underlying transport protocol, and whether you would favour a text-based or binary protocol representation. *[15 marks]*.

Question 4: Services & Security [40 marks]

a) The diagram below shows two mappings that occur prior to sending a packet in the Internet. Identify each mapping, and for each give an example of the syntax used, identify the service or protocol that is employed, and explain how it achieves the mapping. *[10 marks]*



b) Expand the acronym SNMP and draw a diagram showing the key SNMP elements *[5 marks]*
Give three examples of the type of information that might be stored in a Management Information Base (MIB). *[3 marks]*
Show using examples the two main ways in which the SNMP protocol is used to access a MIB. *[7 marks]*

c) Three common network security threats are (i) packet sniffing, (ii) packet spoofing, and (iii) denial of service. Explain the nature of these threats, how they can be implemented, and show some steps that can be taken as countermeasures. *[15 marks]*